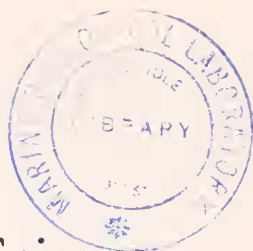


OCCASIONAL PAPERS
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No. 90, 43 pages, 128 figures, 5 maps.

The Harvestmen of Family Triaenoychidae
in North America (Opiliones)

By

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INTRODUCTION

Several recent collecting trips to the Pacific Northwest revealed a large number of unusual phalangids, mostly in the family Triaenonychidae Soerensen. The morphological characters of this family are expanded and clarified by the new series and will be of value in determining phalangid evolution. A significant correlation between undisturbed forest habitat and these phalangids exists.

The order Phalangida is divided into three suborders, the mite-like phalangids in Cyphothalmida, the typical "daddy-long-legs" in Palpatores, and the indolent, shorter-legged phalangids in Laniatores. Of the Laniatores, Triaenonychidae is one of the most widespread families. Found in temperate forests throughout the Southern Hemisphere, this family makes a northern appearance in the forests of western North America with no known representatives in the tropics. The Triaenonychid habitat in North America, except for cavernicolous species, is in coniferous forests which have rather cold, moist winters.

DISTRIBUTION AND TAXONOMY

Early work in this family was compiled and organized by C. Roewer in his book "Die Weberknechte der Erde" published in 1923. At this time Triaenonychids were known from South

Africa, Madagascar, Australia, New Zealand, and Chile, with three species described from northwestern United States. They were distinguished from other phalangids by their three pronged hind claws. Kratochvíl (1958) utilized more detailed studies of the genitalia and found sufficient differences in structure to distinguish the family Triaenonychidae and two related families from others at the superfamily level. The original family character of single posterior claws with a pair of lateral branches must now be expanded to include claws with atrophied branches and claws with two pairs of branches. A reorganized classification of subfamilies by Forster (1954) now should include a new subfamily.

The family Triaenonychidae is represented in North America by five genera which are chiefly distinguished by significant differences in the structure of the posterior claws. One genus (Cyptobunus) is exclusively cavernicolous and has lateral branches on the posterior claws that have atrophied or disappeared entirely. This group is isolated in caves of the Rocky Mountain Cordilleran. The genus Sclerobunus is the best known of the American Triaenonychids and is established in spruce-fir forests from southern Arizona to British Columbia with a peculiar hiatus in California. This genus has the characteristic trifurcate triaenonychid claw with a ventral tooth on the main prong. Two new genera, Metanonychus and Paranonychus, will be placed in a new subfamily. They include a widespread group of darkly pigmented triaenonychids having two pairs of lateral branches on the main prong of the hind claws. These phalangids have been taken from the Aleutian Islands to northern California. The fifth genus, Zuma, has posterior claws similar to those of Sclerobunus but differs in the structure of the eye tubercle. It is restricted to dense forests in central California.

Unless otherwise stated, all specimens are deposited in the collection of the California Academy of Sciences.

Superfamily TRAVUNOIDEA Kratochvíl, Balát and Pelikán, 1958

Family TRIAENONYCHIDAE Soerensen, 1886

Anterior margin of scute usually with three projections flanking chelicerae. Eyes situated on median tubercle. Dorsum with five tergal areas bounded by transverse grooves or rows of tubercles and three free tergites. Ninth tergite fused to anal plate. Palpi robust, without slender, elongated segments. Claws of third and fourth legs with uniform central prong bearing four or less lateral spines in adults and three pairs of lateral spines in juveniles. Pseudo-nychium, arolium, or scopula not present on claws of adults or juveniles. Males with musculature in penis which apparently articulates distal process.

NOTE. The subfamily grouping of Triaenonychidae has been in doubt for many years. The original scheme was based on the shape of the sternum. Forster (1954) later relegated sternal differences to the tribal level and established two

subfamilies on the basis of the shape of the trifurcated claw in New Zealand and Australia. The American triaenonychids also indicate weakness in classifying subfamilies by sterna because many have shapes that are intermediate in the sternal classification system. On the other hand, the structure of the hind claw does reflect a natural division of the family, so I will adopt the subfamily characters of Forster.

Key to Subfamilies of TRIAENONYCHIDAE

- 1. Hind claws with two pairs of branches
on median prong PARANONYCHINAE Briggs, new subfamily
Hind claws with one pair or fewer
branches on median prong. 2
- 2. Hind claws with side branches much
shorter than median prong TRIAENONYCHINAE Pocock
Hind claws with side branches equal in
length to, or longer than, the
median prong SOERENSENELLINAE Forster

Subfamily TRIAENONYCHINAE Pocock

Claws of 3rd and 4th legs with two or less branches on median prong, branches shorter than median prong. Penes with relatively complex apical velum, dorsal plate not chitimized and usually reduced. Eggs not observed in care of adults.

Key to North American Genera of TRIAENONYCHINAE

- 1. Hind claws without ventral tooth,
branches small or absent. Cyptobunus Banks
Hind claws with ventral tooth and
two branches 2
- 2. Eye tubercle conical, on anterior
margin of scute Zuma Goodnight and Goodnight
Eye tubercle subconical, slightly
recessed from anterior margin Sclerobunus Banks

GENUS CYPTOBUNUS BANKS

Cyptobunus Banks, 1905, Ent. News, vol. 16, p. 251. Roewer, 1923, Die Weberknechte der Erde, p. 107.
Sclerobunus (part), Crosby and Bishop, 1924, Ent. News, vol. 35, p. 109. Roewer, 1931, Zeit. Wiss. Zool., vol. 138, p. 153. Goodnight and Goodnight, 1943, Amer. Midland Nat., vol. 29, pp. 646-647.

Scute with segmental areas delineated by shallow grooves. Eye tubercle recessed from anterior margin of scute. Sternum narrow, with opercular branches. Operculum large. Body without black pigment, integument colorless. Chelicerae with fixed finger extending beyond movable finger.

Palpi strongly spinose, femur with at least six strong ventral spines, without sexual dimorphism.

First tarsus with three segments, second with five or more segments, third and fourth with four segments. Femur and second trochanter of first legs with elongate ventral spines. Tarsal claw of hind legs with lateral spines much reduced or absent, ventral tooth absent. Distitarsus of first leg with two segments, of second with three segments. Basal segment of second tarsi longer than remaining segments combined.

Penis with two apical setae, apical dorsal spur, and reduced lateral processes on anterior margin. Ovipositor without setae on ventral lobe.

NOTE. Cyptobunus is not synonymous with Sclerobunus because, chiefly, significant differences exist in the second tarsi, hind tarsal claws, and palpal femora. These genera show a close relationship, however, in the structure of their genitalia.

TYPE SPECIES. Cyptobunus cavicolens Banks.

Key to the Adults of Cyptobunus

1. Hind claws with two reduced lateral branches Cyptobunus cavicolens Banks
Hind claws with one reduced lateral branch 2
2. Cornea large, retina in place behind cornea
 . . . Cyptobunus ungulatus ungulatus Briggs, new species
Cornea small, retina displaced medially
 Cyptobunus ungulatus madhousesensis Briggs, new subspecies

Cyptobunus cavicolens Banks.
(Figures 1-9.)

Cyptobunus cavicolens Banks, 1905, Ent. News, vol. 16, p. 251.

Roewer, 1923, Die Weberknechte der Erde, p. 631.

Sclerobunus robustus, Crosby and Bishop, 1924, Ent. News, vol. 35, p. 109. Roewer, 1931, Zeit. Wiss. Zool., vol. 138, p. 153.

Sclerobunus cavicolens, Goodnight and Goodnight, 1943, Amer. Midland Nat., vol. 29, pp. 646-647.

MALE. Total body length, 1.94 mm. Scute length, 1.53 mm. Length of eye tubercle, 0.19 mm. Scute width, 1.79 mm. Length of second leg, 8.30 mm. Width of eye tubercle, 0.23 mm.

Anterior margin of scute smooth, with weak indentations over chelicerae and weak projections flanking chelicerae. Scute smooth, no posterior tubercles, without pigmentation. Tergites without significant tubercles. Eye tubercle small, abruptly rounded. Eyes with dark, rounded retinas.

Sternum narrow, broadens near operculum. Maxillary processes triangular lobes bearing prominent setae. Operculum large, semicircular, setose.

Palpi with four pairs of spines on tarsus, six or seven ventral spines on femur, two spines on trochanter.

Tarsal formula 3-5-4-4. Femur of first leg with two long ventral spines, second trochanter with one ventral spine. Tarsal claw of hind legs with single prong bearing two minute lateral scales on opposite sides of midpoint.

Penis with lateral setae on rounded apical process, velum on dorsal and ventral surfaces a complex, folded tissue. Ventral transverse flange present.

FEMALE. Similar to male. Ovipositor with blunt lateral and dorsal lobes bearing a few prominent setae.

JUVENILES. Hind tarsi with typical six-branched claws of Triaenonychidae.

SPECIMENS EXAMINED. Montana, Jefferson County. Females, males, and juveniles, Big Spring Room and Cathedral Room of Morrison Cave (Lewis and Clark Caverns), 31 December 1940, Pletsch, Mills, Pepper et al. and 22 February 1941, W. L. Jellison. Deposited in the American Museum of Natural History and Montana State University. Known only from Lewis and Clark Caverns.

Cyptobunus unguatus unguatus Briggs, new species.
(Figures 10-18.)

MALE. Total body length, 2.59 mm. Scute length, 2.21 mm. Length of eye tubercle, 0.22 mm. Scute width, 2.18 mm. Length of second leg, 1.31 mm. Width of eye tubercle, 0.25 mm.

Anterior margin of scute truncate with slight palpal indentation; only a slight central projection exists. Scute smooth, no posterior tubercles, without pigmentation. Tergites lack tubercles or pigmentation. Eye tubercle small, abruptly rounded. Eyes with large rounded retinas.

Sternum very narrow, with indistinct broadening at operculum. Maxillary processes triangular lobes bearing setae. Operculum large, semicircular, setose.

Chelicerae robust.

Palpi with four pairs of spines on tarsus, anterior pair of tarsal spines reduced, ten spines on tibia, seven ventral spines on femur, two spines on trochanter.

Tarsal formula 3-5-4-4. Femur of first leg with two spines, second trochanter with one spine. Tarsal claws of hind legs with single prong bearing one minute scale near midpoint, ectal on fourth legs and mesal on third legs.

Penis with lateral setae on small, circular apical process. Ventral transverse flange present.

FEMALE. Similar to male.

TYPE SPECIMENS. Holotype male, allotype female, Model Cave, near Baker, White Pine County, Nevada, 24 August 1952, R. de Saussure. Deposited in the American Museum of Natural History.

Cyrtobunus unguatus madhousesensis Briggs, new subspecies.
(Figures 19-25.)

FEMALE. Total body length, 2.67 mm. Scute length, 1.91 mm. Length of eye tubercle, 0.17 mm. Scute width, 2.00 mm. Length of second leg, 8.10 mm. Width of eye tubercle, 0.64 mm.

Anterior margin of scute uniformly truncate, with little indication of cheliceral sockets. Scute slightly granular, without pigmentation. Tergites smooth, unpigmented. Eye tubercle small, abruptly rounded, eyes with interconnected retinæ.

Sternum narrow, broadens near operculum. Maxillary processes triangular lobes bearing setae. Operculum large, semicircular.

Palpi with four pairs of spines on tarsus, anterior pairs of tarsal spines reduced, ten spines on tibia, seven ventral spines on femur, two spines on trochanter.

Tarsal formula 3-5 or 6-4-4. Femur of first leg with 3 spines. Second trochanter with one spine. Tarsal claw of hind legs with single prong bearing one minute ectal scale on fourth legs and none on third legs.

Ovipositor with setae on lateral lobes, none on dorsal lobe.

MALE. Not known.

TYPE SPECIMEN. Holotype female, North Madhouse Cave, near Provo, Utah County, Utah, 27 May 1965, 7,500 feet, Stan Moulton. Deposited in the American Museum of Natural History.

GENUS ZUMA GOODNIGHT AND GOODNIGHT

Zuma Goodnight and Goodnight, 1942, Amer. Mus. Novitates, no. 1188. Briggs, 1967, Pan. Pac. Entomol., vol. 43, p. 89.

Anterior margin of scute linear with short median projections. Scute granular, areas distinct. Eye tubercle located on anterior margin of scute, distinctly conical in shape, eyes widely separate. Sternum narrow, with opercular branches. Body with black pigment under integument.

Chelicerae with constriction on basal segment. Palpi with stout spines, femur with three prominent proximal ventral spines, without sexual dimorphism. Tarsal formula 3-5-4-4. Distitarsus of first leg with two segments, of second with three. Basal segment of second tarsi shorter than remaining segments combined. Femur and second trochanter of first legs with weak ventral spines. Tarsal claw of hind

legs with pair of branches, median prong with ventral tooth. Metatarsi with astragulus and calcaneus.

Penis with two apical setae, sclerotized ventral plate, distal section without dorsal or lateral processes. Ovipositor without setae on ventral lobe, with setae on lateral lobes.

TYPE SPECIES. Zuma acuta Goodnight and Goodnight.

Key to the Females of Zuma

Adults with yellow-brown integument underlain by black pigment, if black pigmentation diminished, integument colorless.

Low elevation habitat

. Zuma acuta Goodnight and Goodnight

Live adults with yellow integument underlain by very faint black pigment.

Above 4,000 feet Zuma tioga Briggs, new species

Zuma acuta Goodnight and Goodnight.

(Figures 26-35.)

Zuma acuta Goodnight and Goodnight, 1942, Amer. Mus. Novitates, no. 1188. Briggs, 1967, Pan Pac. Entomol., vol. 43, p. 89.

MALE. Total body length, 1.9 mm. Scute length, 1.14 mm. Length of eye tubercle, 0.31 mm. Scute width, 1.33 mm. Length of second leg, 4.27 mm. Width of eye tubercle, 0.27 mm.

Anterior margin of scute with rounded shoulders. Scute granulate. Integument brownish yellow. Cephalothorax with intricate pattern of dark pigment. Areas continuously pigmented except for four pairs of light lateral spots and light band between areas four and five. Tergites each with a band of dark pigment and a pair of light lateral spots. Eye tubercle conical, large, about one third width of scute at its position.

Maxillary processes of second coxae lightly setose, rounded lobes. Operculum barely extends to third coxae.

Chelicerae with base of distal segment setose.

First leg with spine bearing tubercle on first and second trochanters, two spine bearing tubercles on base of femur. All legs with dark pigmentation.

Penis with truncated apex and two lateral setae.

FEMALE. Similar to male.

JUVENILES. Hind claws with three pairs of lateral branches.

NEW RECORDS. CALIFORNIA: Monterey County: Near Pfeiffer Falls, Big Sur, 2 July 1967, T. Briggs, T. Lee, and B. Leong; 3.5 miles east of Highway 1 on Bixby Canyon Road, 9 July 1967, T. Briggs. San Mateo County: 0.7 miles east of

junction of Cloverdale and Canyon roads, 15 August 1965, T. Briggs and V. F. Lee; 1.7 miles west of Woodside on King's Mountain Road, 23 January 1966, K. Hom and T. Briggs; 7 miles from Cloverdale Road on Butano Creek, 15 August 1965, T. Briggs and V. F. Lee; 4.0 miles south of junction of State Highway 35 and Half Moon Bay Road, San Francisco Game Refuge, 15 August 1965, T. Briggs, V. F. Lee, and K. Hom. Santa Cruz County: Empire Cave, near Santa Cruz, 17 April 1966, T. Briggs, V. F. Lee, and K. Hom; Empire Cave, 11 June 1966, V. F. Lee and T. Briggs; Empire Cave, 26 August 1963, R. Graham. Dolloff Cave, near Santa Cruz, 19 March 1966, K. Hom.

NOTE. Populations of Zuma acuta found in Empire Cave, near Santa Cruz, Santa Cruz County show some loss of pigmentation. The type is from Redwood City, California.

Zuma tioga Briggs, new species.
(Figures 36-41.)

FEMALE. Total body length, 1.68 mm. Scute length, 1.06 mm. Length of eye tubercle, 0.19 mm. Scute width, 1.21 mm. Length of second leg, 4.19 mm. Width of eye tubercle, 0.23 mm.

Anterior margin of scute with rounded shoulders. Scute with only slight indication of black pigmentation. Integument yellow. Five bands of faint dark pigment indicate scutal areas. Scute granulate. Tergites granulate, with very faint dark pigment. Integument yellow. Eye tubercle width about one fourth scute width at its position, conical.

Maxillary processes of second coxae lightly setose, rounded lobes. Operculum barely extends to third coxae.

Chelicerae with base of distal segment setose.

Legs with traces of black pigmentation.

MALE. Unknown, may not exist.

JUVENILES. Hind claws with three pairs of lateral branches.

TYPE SPECIMEN. Holotype female, 3.8 miles northeast of Crane Flat Ranger Station, Yosemite National Park, Tuolumne County, California, 21 July 1968, G. Leung, M. Wong, and T. Briggs.

OTHER LOCALITIES. CALIFORNIA: Mariposa County: 5.8 miles west of Crane Flat Ranger Station, Yosemite National Park, 28 July 1967, (7000 feet), T. Briggs. Tuolumne County: 5.0 miles west of Crane Flat Ranger Station, Yosemite National Park, 28 July 1967, (5000 feet), T. Briggs and A. Lee; North Crane Creek Camp, Yosemite National Park, 21 July 1968, T. Briggs.

GENUS SCLEROBUNUS BANKS

Scotolemon (part), Packard, 1877, Bull. U. S. Geol. Geogr.

Surv. Terr., vol. 3, p. 164.

Phalangodes (part), Packard 1888, Mem. Nat. Acad. Sci., vol.

4, p. 48.

Sclerobunus Banks, 1893, Trans. Amer. Ent. Soc., vol. 20, p. 152. Banks, 1901, Amer. Natural., vol. 35, p. 672.
Roewer, 1923, Die Weberknechte der Erde, p. 596.

Anterior margin of scute linear, with short median projections. Shoulders with tubercles. Scute granular, areas distinct. Eye tubercle rounded, recessed from anterior margin of scute. Sternum narrow, with opercular branches. Operculum of average size. Body with faint black pigment, integument deep reddish brown.

Chelicerae with constriction on basal segment. Palpi with stout spines, femur with three prominent proximal ventral spines. Some species with dimorphic swelling of palpal femur. Tarsal formula 3-5-4-4. Distitarsus of first leg with two segments, of second with three. Basal segment of second tarsi shorter than remaining segments combined. Tarsal claw of hind legs with pair of strong branches, median prong with ventral tooth. Femur and second trochanter of first legs with stout ventral spines.

Penis with two apical setae, and apical dorsal spur and apical lateral processes. Ovipositor without setae on ventral lobe, setae present on lateral lobes.

Hind claws of juveniles with three pairs of branches.

TYPE SPECIES. Scotolemon robustus Packard.

Key to the Males of Sclerobunus

1. Palpal femur of males swollen 2
Palpal femur of males not swollen
. Sclerobunus nondimorphicus Briggs, new species
2. Body with only traces of black
pigment Sclerobunus robustus robustus (Packard)
Body with areas of black pigment 3
3. Body with much black pigment,
scute more than 2 mm. long
Sclerobunus robustus idahoensis Briggs, new subspecies
Body with moderate black pigment,
scute less than 2 mm. long
Sclerobunus robustus glorietus Briggs, new subspecies

Sclerobunus nondimorphicus Briggs, new species.
(Figures 42-53.)

Sclerobunus robustus (Packard). Banks, 1893, Trans. Amer. Ent. Soc., vol. 20, p. 152.

MALE. Total body length, 2.76 mm. Scute length, 2.36 mm. Length of eye tubercle, 0.34 mm. Scute width, 2.30 mm. Length of second leg, 7.80 mm. Width of eye tubercle, 0.34 mm.

Anterior margin of scute with zero to four pairs of tubercles on shoulders. Scute with integument orange, black pigmentation faint to nil. Tergites with pigmentation slightly darker than on scute, but lighter than other Sclerobunus. Eye tubercle a rounded mound.

Sternum with median groove. Maxillary processes rounded and setose. Operculum extends close to third coxae.

Palpi of male not swollen at femur.

First leg with 2 or 3 spines on femur. Penis with sclerotization at base of apical setae, distolateral velum projections moderately acute.

FEMALE. Similar to male.

TYPE SPECIMENS. Holotype male and allotype female. 8.6 miles northwest of Easton on U. S. Highway 90, Kittitas County, Washington, 23 June 1966, T. Briggs, V. F. Lee, A. Jung, and K. Hom.

OTHER LOCALITIES. BRITISH COLUMBIA: 10.6 miles east of Hope near Manning Park, 23 August 1969, T. Briggs. 17.8 miles east of Hope near Manning Park, 23 August 1969, T. Briggs. OREGON: Clackamas County: 3 miles southeast of Rhododendron, 5 September 1970, T. Briggs, K. Hom, R. Lem, W. Lum, and J. Nishio. Clatsop County: 1 mile south of Saddle Mountain State Park, 2 August 1967, T. Briggs and A. Jung. Columbia County: 5.5 miles south of Clatskanie, 8 August 1967, K. Hom. WASHINGTON: Grays Harbor County: 6.8 miles south of Neilton, 22 June 1966, T. Briggs, V. F. Lee, A. Jung, and K. Hom; 20.8 miles east of Queets on Highway 101, 22 June 1966, V. F. Lee, and A. Jung. Jefferson County: 11.5 miles southwest of Hoh Rain Forest Road on Highway 101, 22 June 1966, A. Jung; 1.5 mile northeast of Maynard, 23 August 1966, T. Briggs, A. Jung, K. Hom, and V. F. Lee. King County: 16.4 miles northwest of Hyak on U. S. Highway 90, 23 June 1966, T. Briggs, V. F. Lee, A. Jung, and K. Hom. Lewis County: Chanapecosh, Mt. Rainier National Park, 8 August 1955, V. Roth.

Sclerobunus robustus robustus (Packard).
(Figures 54-60.)

Scotolemon robustus Packard, 1877, Bull. U. S. Geol. Geogr. Surv. Terr., vol. 3, p. 164. [Type: Southwestern

Colorado; Mus. Comp. Zool., Harvard.] Banks, 1902, Proc. Acad. Nat. Sci. Phil., vol. 53, p. 593.

Phalangodes robustus, Packard, 1888, Mem. Nat. Acad. Sci., vol. 4, p. 48.

Sclerobunus robustus, Banks, 1893, Trans. Amer. Ent. Soc., vol. 20, p. 152. Banks, 1901, Amer. Natural., vol. 35, p. 672. Banks, 1911, Pomona Jour. Ent., vol. 3, p. 416. Roewer, 1923, Die Weberknechte der Erde, p. 597.

MALE. Total body length, 3.09 mm. Scute length, 2.44 mm. Eye tubercle length, 0.34 mm. Scute width, 2.35 mm. Length of second leg, 7.18 mm. Eye tubercle width, 0.38 mm.

Anterior margin of scute with two to four pairs of tubercles on shoulders. Scute with orange integument, black pigment faint. Dark patches at ends of anterior scutal groove and dark band on each scutal area. Four pairs of lateral light spots on posterior of scute. Tergites granular with central band of dark pigment. Eye tubercle a rounded cone slightly recessed from anterior margin. Median of eye tubercle with light longitudinal band. Eyes joined by dark retinal pigment.

Maxillary processes acute and setose. Operculum setose, does not extend to third coxae.

Chelicerae with large dorsal tubercles on distal segment. Base of distal segment setose. Male palpi with swollen femur.

First leg with ventral spine on first and second trochanters, two ventral spines on femur.

Penis with dorsal and ventral plates obscured by complex velum. Distolateral projections from velum spine-like. Ventral transverse groove present.

FEMALE. Palpi with normal femur.

NEW RECORDS. ARIZONA: Apache County: 2.4 miles north of Alpine on U. S. Highway 666, 18 August 1967, T. Briggs, K. Hom, and P. Lum. Cochise County: Barfoot Meadows, Chiricahua Mountains, 28 July 1963, (8800 feet), V. Roth. Coconino County: 7 miles north of Flagstaff, San Francisco Mountains, 5 August 1967, D. S. Rentz; Arizona Snowbowl, Flagstaff, 24 August 1967, T. Briggs, K. Hom, A. Jung, J. Tom, and P. Lum. Graham County: Hospital Flat, Mt. Graham, 19 August 1952, (9050 feet), H. B. Leech and J. W. Green; Mt. Graham, 19 August 1952, (10,000-10,500 feet), H. B. Leech and J. W. Green; Hospital Flat, 2 August 1965, H. B. Leech. Pima County: 30 miles northeast of Tucson, Santa Catalina Mountains, T. Briggs and K. Hom. NEW MEXICO: Los Alamos County: 4.2 miles west of Los Alamos, 15 August 1968, (7,700 feet), T. Briggs and K. Hom. Otero County: 6.0 miles southeast of Mescalero, 14 August 1968, (6500 feet), K. Hom; 2 miles west of Cloudcroft, 14 August 1968, (8000 feet), J. Tom, D. Owyang, B. Rogers, K. Hom, and T. Briggs. Sierra County: 0.8 miles east of Emory Pass, 16 August 1968, (8000 feet), T. Briggs, K. Hom, and D. Owyang.

NOTE. Southern subspecies of Sclerobunus robustus are found at high altitudes in the fir forests of isolated desert mountains. The isolated populations are remarkably undifferentiated, even from northern subspecies.

Sclerobunus robustus idahoensis Briggs, new subspecies.
(Figures 61-66.)

MALE. Total body length, 3.03 mm. Scute length, 2.24 mm. Eye tubercle length, 0.35 mm. Scute width, 2.44 mm. Length of leg, 7.94 mm. Eye tubercle width, 0.44 mm.

Anterior margin of scute with three or four pairs of tubercles on shoulders. Scute with pattern similar to Sclerobunus robustus robustus, but with much more black

pigment. Tergites with dark pigment. Eye tubercle a rounded mound.

Sternum with deep median groove. Maxillary processes rounded and setose, two dark tubercles are present on some specimens. Operculum extends to third coxae.

Palpi with slightly swollen femur on males.

Penis with distolateral velum projections moderately acute.

FEMALE. Palpal femur normal.

TYPE SPECIMENS. Holotype male and allotype female. 2.8 miles northwest of Clarkia on State Highway 3, Shoshone County, Idaho. 11 August 1967, T. Briggs, K. Hom, and A. Jung.

OTHER LOCALITIES. IDAHO: Clearwater County: 6.3 miles north of Headquarters, 12 August 1967, T. Briggs. Idaho County: Apgar Campground, Clearwater National Forest, 12 August 1967, T. Briggs. Shoshone County: 17.25 miles southwest of Little North Fork of Clearwater River on Clearwater Road, 11 August 1967, T. Briggs, K. Hom, and A. Jung; 6.2 miles southeast of Lolo Pass on U. S. Highway 12, 18 August 1967, T. Briggs and K. Hom.

Sclerobunus robustus glorietus Briggs, new subspecies.
(Figures 67-72.)

MALE. Total body length, 2.18 mm. Scute, 1.82 mm. Eye tubercle length, 0.34 mm. Scute width, 1.82 mm. Length of second leg, 4.50 mm. Eye tubercle width, 0.35 mm.

Anterior margin of scute with two or three pairs of shoulder tubercles. Pigmentation darker than Sclerobunus robustus nondimorphicus but lighter than Sclerobunus robustus idahoensis. Eye tubercle a rounded cone.

Sternum with median groove. Maxillary processes rounded and setose.

Palpi with swollen femur on males. First leg with black pigmentation. Penis with distolateral velum projections sharply acute.

FEMALE. Body pigmentation lighter than in males. Palpal femur normal.

TYPE SPECIMENS. Holotype male and allotype female. 4 miles southeast of Glorieta Baldy Lookout, Santa Fe County, New Mexico, 14 August 1968, T. Briggs, K. Hom, and D. Owyang.

PARANONYCHINAE Briggs, new subfamily

Claws of third and fourth legs with two pairs of branches on median prong. Penis with relatively simple apical velum, dorsal plate chitenized. Eggs not observed in care of adults. Setose space between posterior of sternum and opercular opening. Prominent sutures at juncture of fused sternites.

Key to Genera of PARANONYCHINAE

- Hind claws with ventral tooth on
 median prong Metanonychus Briggs, new genus
 Hind claws without ventral tooth on
 median prong Paranonychus Briggs, new genus

PARANONYCHUS BRIGGS, NEW GENUS

Scute with areas clearly delineated, prominent eye tubercle on anterior margin. Sternum broad with parallel sides and blunt apex. Spiracles exposed.

Palpi weakly armed, palpal spines simple, femur with missing ventral spines.

Tarsal formula 3-5-4-4. Distitarsi of first legs with two segments, of second with three segments. Femur of first leg with one or two ventral spines, second trochanter of first leg with one ventral spine. Claws on third and fourth tarsi with two pairs of lateral branches, median prong without ventral tooth. Sexual dimorphism not apparent in palpi or chelicerae. Gland in tubercle on mesal apex of fourth coxae.

Penis with sclerotized dorsal process and no ventral process. Ovipositor with prominent lateral setae, but no dorsal or ventral setae.

Juveniles with typical hind claws of Triaenonychidae.

TYPE SPECIES. Sclerobunus brunneus Banks.

Key to the Males of Paranonychus

- Dorsal process of penis tubular, with
 acute apex Paranonychus brunneus Banks
 Dorsal process of penis flattened,
 with beveled apex
 Paranonychus concolor Briggs, new species

Paranonychus brunneus (Banks).
 (Figures 73-80.)

Sclerobunus brunneus Banks, 1893, Trans. Amer. Soc., vol. 20, p. 152. Banks, 1911, Pomona Jour. Ent., p. 597. Goodnight and Goodnight, 1943. Amer. Midland Nat., vol. 29, p. 645. Roewer, 1923, Die Weberknechte der Erde, p. 597.
Sclerobunus robustus, Roewer, 1931, Zeit. Wiss. Zool., vol. 138, p. 153.

MALE. Total body length, 1.95 mm. Scute length, 1.62 mm. Length of eye tubercle, 0.34 mm. Scute width, 1.62 mm. Length of second leg, 3.60 mm. Width of eye tubercle, 0.32 mm.

Anterior margin of scute rounded. Scute granular, mottled with dark pigment, areas clearly delineated with furrows and tubercles, integument yellow-brown. Tergites granular, dark pigment posterior margin, posterior tubercles present. Eye tubercle conical, extends over anterior margin of scute, eyes in dark pigment zones at base. Maxillary processes from second coxae setose, reduced, widely separated by sternum. Operculum extends to third coxae, dorsal groove usually present.

Chelicerae with short fingers, chelicerae unpigmented.

Palpi reduced, weak spines on tibia and tarsus, femur with but one ventral spine. Black pigment absent from palpi.

Tarsal claw of hind legs with proximal pair of lateral spines slightly shorter than distal pair. Black pigment may or may not be absent from distal end of each leg segment, tarsi usually lightly pigmented.

Penis without ventral process, dorsal process a narrow, subcylindrical spur longer than operculum. Two pairs of short lateral setae near apex.

FEMALE. Operculum truncate, does not extend to third coxae. Ovipositor with elongated, acute lobes. Setae present only on lateral lobes. Female broader than male.

NEW RECORDS. BRITISH COLUMBIA: 17.8 miles east of Hope, Manning Park, 23 August 1969, T. Briggs; Garibaldi, 22 August 1969, T. Briggs; Mt. Seymour Park, 23 August 1969, W. Lum and R. Lem; 4 miles north of Britannia Beach, 23 August 1969, T. Briggs. ALASKA: Atka Island, 28 July 1907, E. C. Van Dyke. OREGON: Clackamas County: 3 miles southeast of Rhododendron, 5 September 1970, T. Briggs, K. Hom, R. Lem, W. Lum, and J. Nishio. Columbia County: 5.5 miles south of Clatskanie, 8 August 1967, T. Briggs. Lincoln County: 0.5 miles east of Cape Perpetua, 7 August 1967, K. Hom. WASHINGTON: Skamania County: 1.0 miles due north of Swift Reservoir Dam, 21 June 1966, V. F. Lee, A. Jung, K. Hom, and T. Briggs. Kittitas County: 8.6 miles northwest of Easton, 23 June 1966, K. Hom, V. F. Lee, and T. Briggs; Hyak, 25 August 1969, T. Briggs. Jefferson County: 0.5 miles west of HOH entrance to Olympic National Park, 21 June 1966, V. F. Lee.

NOTES. The record for Paranonychus brunneus from Atka Island, Alaska, consists of a single female which agrees with this species. Atka Island, however, may not have had trees in 1906 and, therefore, was an unlikely habitat for Paranonychus. Juveniles have the typical integument of immature specimens but are unusual in possessing black pigment beneath the integument that is normally found in adults. Large numbers of juveniles were encountered in many of the collecting localities.

Paranonychus concolor Briggs, new species.

MALE. Total body length, 1.84 mm. Eye tubercle length, 0.33 mm. Scute length, 1.44 mm. Eye tubercle width, 0.31 mm. Scute width, 1.48 mm. Length of second leg, 3.94 mm.

Anterior margin of scute rounded. Scute granular, faintly mottled with dark pigment, scutal areas darkest.

Tergites granular, faint dark pigment on posterior margin, posterior tubercles present. Eye tubercle conical, extends to anterior margin of scute, eyes in dark pigment zones at base. Maxillary processes from second coxae setose, reduced, widely separated by sternum. Operculum extends to third coxae, without dorsal groove. Integument of body distinctly yellow.

Palpi reduced, weak spines on tibia and tarsus, femur with two widely separate ventral spines.

Tarsal claw of hind legs with hind pair of lateral spines slightly shorter than distal pair. Legs darker than body, tarsi lightly pigmented.

Penis without ventral process, dorsal process a flattened, transparent, sclerotized spur about equal to length of operculum. Two pairs of elongate lateral setae near beveled apex.

FEMALE. Operculum shortened, does not extend to third coxae. Ovipositor small.

TYPE SPECIMENS. Holotype male and allotype female. 6.6 miles south of Drew along Highway 227, Douglas County, Oregon, T. Briggs.

METANONYCHUS BRIGGS, NEW GENUS

Scute with areas clearly delineated, rounded eye tubercle on anterior margin. Sternum narrow, with acute apex, widening at juncture of second and third coxae and third and fourth coxae. Spiracles exposed. Integument yellow.

Palpi weakly or moderately armed with compound spines, femur with normal ventral spines.

Tarsal formula 3-5-4-4. Distitarsi of first legs with two segments, of second with three segments. Femur of first legs with one to three ventral spines, second trochanter of first leg with one spine. Claws on third and fourth tarsi with two pairs of lateral branches, median prong with a ventral tooth. Sexual dimorphism exists in some species.

Penis with sclerotized dorsal process which may be reduced and prominent ventral process bearing aedeagus. Ovipositor with lateral setae.

JUVENILES. Hind claws as in typical Triaenonychidae.

TYPE SPECIES. Metanonychus idahoensis Briggs, new species.

Key to the Males of Metanonychus

- 1. Dorsal process of penis a sclerotized spine, apical setae absent 2
- Dorsal process of penis a sclerotized plate, apical setae present 3
- 2. Dorsal process of penis a minute spine near apex of ventral process
Metanonychus nigricans nigricans Briggs, new species

Dorsal process of penis a prominent
spine widely separated from ventral
process
Metanonychus nigricans oregonus Briggs, new subspecies

3. Ventral swelling or spur on base of
male palpal tarsus
. Metanonychus idahoensis Briggs, new species
No ventral swelling or spur on base
of male palpal tarsus 4

4. Dorsal plate of penis broader than ventral
process and with pointed apex
. Metanonychus setulus setulus Briggs, new species
Dorsal plate not significantly broader
than ventral process, apex rounded
or blunt 5

5. Dorsal plate of penis curves strongly
toward ventral process resulting in
a median separation
. Metanonychus setulus mazamus Briggs, new subspecies
Dorsal plate flush with ventral process 6

6. Dorsal plate of penis cleft medially
. Metanonychus setulus navarrus Briggs, new subspecies
Dorsal plate entire at apex 7

7. Adults small; northern California
. Metanonychus setulus obrieni Briggs, new subspecies
Adults normal size; Oregon Cascades
. Metanonychus setulus cascades Briggs, new subspecies

Metanonychus nigricans nigricans Briggs, new species.
(Figures 81-86.)

MALE. Total body length, 1.62 mm. Scute length, 1.44 mm. Length of eye tubercle, 0.23 mm. Scute width, 1.42 mm. Length of second leg, 4.65 mm. Width of eye tubercle, 0.25 mm.

Anterior margin of scute rounded at shoulders. Scute granular, mottled with dark pigment, areas clearly delineated with furrows and tubercles. Tergites granular, with central band of dark pigment. Integument pale yellow-brown. Eye tubercle a rounded mound near anterior margin of cephalothorax. Light median stripe on tubercle not continuous. Maxillary processes from second coxae setose and blunt. Operculum tangent to third coxae, without groove for penis.

Chelicerae with narrow constriction on basal segment.

Palpi with strong spines on tibia and tarsi, femur with four to five strong ventral spines.

Black pigment continuous on legs, tarsi with black pigment. Distal branches on hind claws elongate.

Penis with very small, sclerotized dorsal spur near apex.

Ventral transverse flange prominent. Apical pair of setae absent.

FEMALE. Similar to male in structure. Ovipositor with reduced dorsal and ventral lobes.

TYPE SPECIMENS. Holotype male and allotype female. 0.4 miles north of Del Norte Coast Redwood State Park, Del Norte County, California, 25 June 1966, V. F. Lee, A. Jung, and K. Hom.

OTHER LOCALITIES. CALIFORNIA: Del Norte County: 1.6 miles north of Del Norte Coast Redwood State Park, 25 June 1966, V. F. Lee and A. Jung; 15.8 miles north of Humboldt County Line on U. S. Highway 101, 30 January 1967, V. F. Lee. Humboldt County: Near Orick, 18 June 1966, V. F. Lee.

Metanonychus nigricans oregonus Briggs, new subspecies.
(Figures 87-94.)

MALE. Total body length, 1.77 mm. Scute length, 1.32 mm. Length of eye tubercle, 0.28 mm. Scute width, 2.56 mm. Length of second leg, 4.49 mm. Width of eye tubercle, 0.30 mm.

Body mottled with dark pigment. Eye tubercle with light median stripe nearly continuous, black pigment joins retinae.

Femur of first leg with two to three prominent spines on femur, one on trochanter.

Penis with dorsal process a recurved spine widely separated from ventral process.

FEMALE. Similar to male.

TYPE SPECIMENS. Holotype male and allotype female. 0.7 miles due west of Blodgett, Benton County, Oregon, 20 June 1966, T. Briggs, V. F. Lee, and K. Hom.

OTHER LOCALITIES. OREGON: Curry County: 4.5 miles south of Gold Beach, 19 June 1966, T. Briggs, V. F. Lee, and K. Hom. Lincoln County: 0.5 miles east of Cape Perpetua on U. S. Highway 101, 7 August 1967, K. Hom; 7.7 miles northwest of Eddyville, 20 June 1966, T. Briggs, V. F. Lee, and K. Hom.

Metanonychus idahoensis Briggs, new species.
(Figures 95-104.)

MALE. Total body length, 1.39 mm. Scute length, 1.41 mm. Length of eye tubercle, 0.17 mm. Scute width, 1.13 mm. Length of second leg, 2.74 mm. Width of eye tubercle, 0.19 mm.

Anterior margin of scute rounded at shoulders. Scute granular, areas clearly delineated by unpigmented furrows, integument yellow-brown. Tergites granular, with central band of dark pigment. Eye tubercle with light median stripe nearly continuous. Dark retinal pigment joins eyes. Sternum narrow, with broadening at juncture of second and third coxae and at operculum. Maxillary processes from second coxae setose and acute. Operculum extends over base of third

coxae, without groove for penis.

Chelicerae with constriction on basal segment.

Palpi with two or three prominent ventral spines on femur. Ectal spur on base of tarsus.

Dark pigmentation increases distally on legs. Femur of first leg with one prominent ventral spine, second trochanter with one, and trochanter with one or two. Hind claws with equal branches.

Penis with ventral flange and pair of apical setae. Ventral and dorsal plates parallel, truncate at apex.

FEMALE. Similar to male but lacks ectal spur on base of palpal tarsus. Slightly larger in size.

JUVENILES. Hind claws with three pairs of lateral branches.

TYPE SPECIMENS. Holotype male and allotype female. 2.8 miles northwest of Clarkia on State Highway 3, Shoshone County, Idaho, 11 August 1967, T. Briggs, K. Hom, A. Jung, P. Lum, and J. Tom.

OTHER LOCALITIES. IDAHO: Idaho County: Apgar Campground, Clearwater National Forest, 12 August 1967, T. Briggs. Shoshone County: 1.5 miles northeast of Little North Fork of Clearwater River on Clearwater Road, 11 August 1967, T. Briggs; 17.3 miles southwest of Little North Fork of Clearwater River on Clearwater Road, 12 August 1967, T. Briggs, K. Hom, and A. Jung.

Metanonychus setulus setulus Briggs, new species.
(Figures 105-108.)

MALE. Total body length, 1.41 mm. Scute length, 1.08 mm. Length of eye tubercle, 0.22 mm. Scute width, 1.63 mm. Length of second leg, 3.16 mm. Width of eye tubercle, 0.25 mm.

Anterior margin of scute rounded at shoulders. Scute granular, areas clearly delineated by unpigmented furrows, integument yellow-brown. Tergites granular, with central band of dark pigment. Eye tubercle a rounded mound at anterior margin of scute. Light median stripe nearly continuous. Sternum narrow, with broadening at juncture of second and third coxae and at juncture of third and fourth coxae. Maxillary processes from second coxae setose and acute. Operculum extends over base of third coxae, without groove for penis.

Chelicerae with constriction on basal segment.

Palpi with strong spines on tibia and tarsi, femur with one strong ventral spine.

Femur of first leg with three ventral spines, trochanter with one. Black pigment nearly continuous on legs. Hind claws with equal branches.

Penis with dorsal plate broader than ventral process, apex acute. Ventral flange and pair of apical setae present.

FEMALE. Similar to male structure.

TYPE SPECIMENS. Holotype male and allotype female. Honeyman State Park, Lane County, Oregon, 20 June 1966,

T. Briggs and V. F. Lee.

OTHER LOCALITIES. OREGON: Clatsop County: Saddle Mountain State Park, 5 June 1955, V. Roth; 7 miles north of Nehalem, 26 August 1969, T. Briggs; 2.7 miles north of Cannon Beach, 26 August 1969, T. Briggs. Coos County: Bridge, Camp Myrtlewood, 25 July 1955, V. Roth. Curry County: 4.5 miles south of Gold Beach, 19 June 1966, T. Briggs, V. F. Lee, and K. Hom. Lane County: 0.6 miles south of entrance to Honeyman State Park, 19 June 1966, V. F. Lee; 0.3 miles east of Highway 101 on Cape Creek Road, near Heceta Head, 3 September 1970, T. Briggs, K. Hom, J. Tom, R. Lem, and W. Lum. Lincoln County: 7.7 miles northwest of Eddyville, 20 June 1966, V. F. Lee and K. Hom; 0.5 miles north of Depot Bay, 4 September 1970, T. Briggs, K. Hom, R. Lem, W. Lum, and J. Tom.

NOTE. Northern specimens of Metanonychus setulus setulus tend to have yellow integument exposed on their movable tergites.

Metanonychus setulus mazamus Briggs, new subspecies.
(Figures 109-116.)

MALE. Total body length, 1.42 mm. Scute length, 1.12 mm. Length of eye tubercle, 0.17 mm. Scute width, 1.12 mm. Length of second leg, 2.87 mm. Width of eye tubercle, 0.19 mm.

Penis with dorsal plate curved toward ventral plate resulting in medial separation; about equal in length to ventral plate and truncate at apex.

TYPE SPECIMENS. Holotype male and allotype female. 1.9 miles east of junction of Interstate 5 and Speaker Road, Wolf Creek, Josephine County, Oregon, 6 August 1967, T. Briggs.

OTHER LOCALITIES. OREGON. Douglas County: 2.2 miles south of Canyonville, 6 August 1967, T. Briggs; 6.6 miles south of Drew, along Highway 227, 18 August 1969, T. Briggs.

Metanonychus setulus navarrus Briggs, new subspecies.
(Figures 117-124.)

MALE. Total body length, 1.16 mm. Scute length, 1.00 mm. Length of eye tubercle, 0.18 mm. Scute width, 0.93 mm. Length of second leg, 2.70 mm. Width of eye tubercle, 0.20 mm.

Penis with dorsal and ventral plates parallel and about equal in length. Dorsal plate with longitudinal cleavage at apex and lacking in dark pigment.

TYPE SPECIMENS. Holotype male and allotype female. 1.5 miles south of Little River, Mendocino County, California, 3 July 1966, T. Briggs, V. F. Lee, A. Jung, and K. Hom.

OTHER LOCALITIES. CALIFORNIA: Del Norte County: 15.8 miles north of county line (south boundary) on U. S. Highway 101, 30 January 1967, V. F. Lee.

Metanonychus setulus obrieni Briggs, new subspecies.
(Figures 125-128.)

MALE. Total body length, 1.13 mm. Scute length, 0.86 mm. Length of eye tubercle, 0.20 mm. Scute width, 0.88 mm. Length of second leg, 2.37 mm. Width of eye tubercle, 0.17 mm.

Tergites darkly pigmented.

Penis with ventral dorsal plates parallel, truncate at apex, and about equal in length.

TYPE SPECIMENS. Holotype male and allotype female. Fort Dick, Del Norte County, California, 2 July 1966, C. W. O'Brien.

Metanonychus setulus cascades Briggs, new subspecies.

MALE. Total body length, 1.44 mm. Scute length, 0.97 mm. Length of eye tubercle, 0.19 mm. Scute width, 0.97 mm. Length of second leg, 2.77 mm. Width of eye tubercle, 0.19 mm.

Penis with ventral and dorsal plates parallel, truncate at apex. Penis similar to that of Metanonychus idahoensis.

FEMALE. Larger than male, operculum shorter than that of male.

TYPE SPECIMENS. Holotype male and allotype female. 9.0 miles north of Marion Forks, Marion County, Oregon, 27 August 1969, (3,000 ft.) T. Briggs.

OTHER LOCALITIES. OREGON: Clackamas County: 2.5 miles northwest of Brightwood, 5 September 1970, T. Briggs, K. Hom, R. Lem, W. Lum, and J. Tom.

FOREST RELATIONSHIPS

All travunoids are basically forest animals and are a surprisingly good indicator of the health of a forest. I have found innumerable times that heavily lumbered forests are devoid of these arachnids, while adjacent primary stands of trees support an abundance of specimens. They are unaffected by a sparse removal of trees, but any forest once cut so only stumps or less remain of the original trees is not repopulated with triaenonychids and other travunoids even if a tree farm stand has replaced the forest for many years. Any forest lumbered to a succession stage of brushy undergrowth or non-climax trees does not contain these arachnids. One might conclude, therefore, that triaenonychids have great difficulty in adapting to changes in their environment.

Good examples of this relationship between triaenonychids and forest health were observed in comparing lumbered and unlumbered portions of San Mateo County Memorial Park, California; Butano Ridge of San Mateo County, California; Honeyman State Park of Lane County, Oregon; south of Gold Beach, Curry County, Oregon; and numerous locations in the Olympic

National Forest of Washington.

LIVE OBSERVATIONS

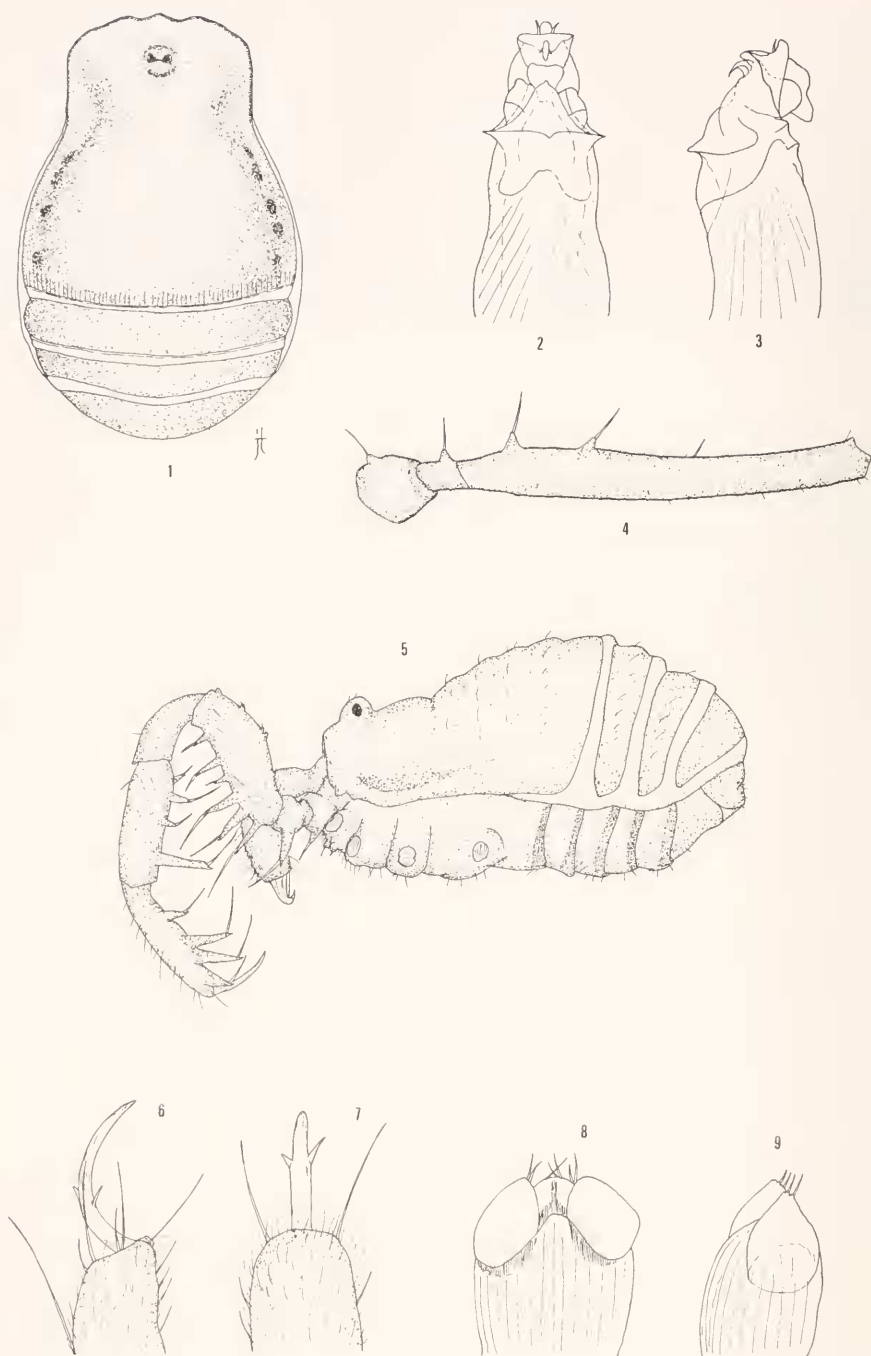
Specimens in all stages of development seem to prefer the undersurface of wood in a moist forest habitat. The only feeding record was that of an individual Sclerobunus robustus devouring a small campodid at time of capture. Specimens of Sclerobunus nondimorphicus were offered to various reptiles and amphibians, but were rejected.

ACKNOWLEDGEMENTS

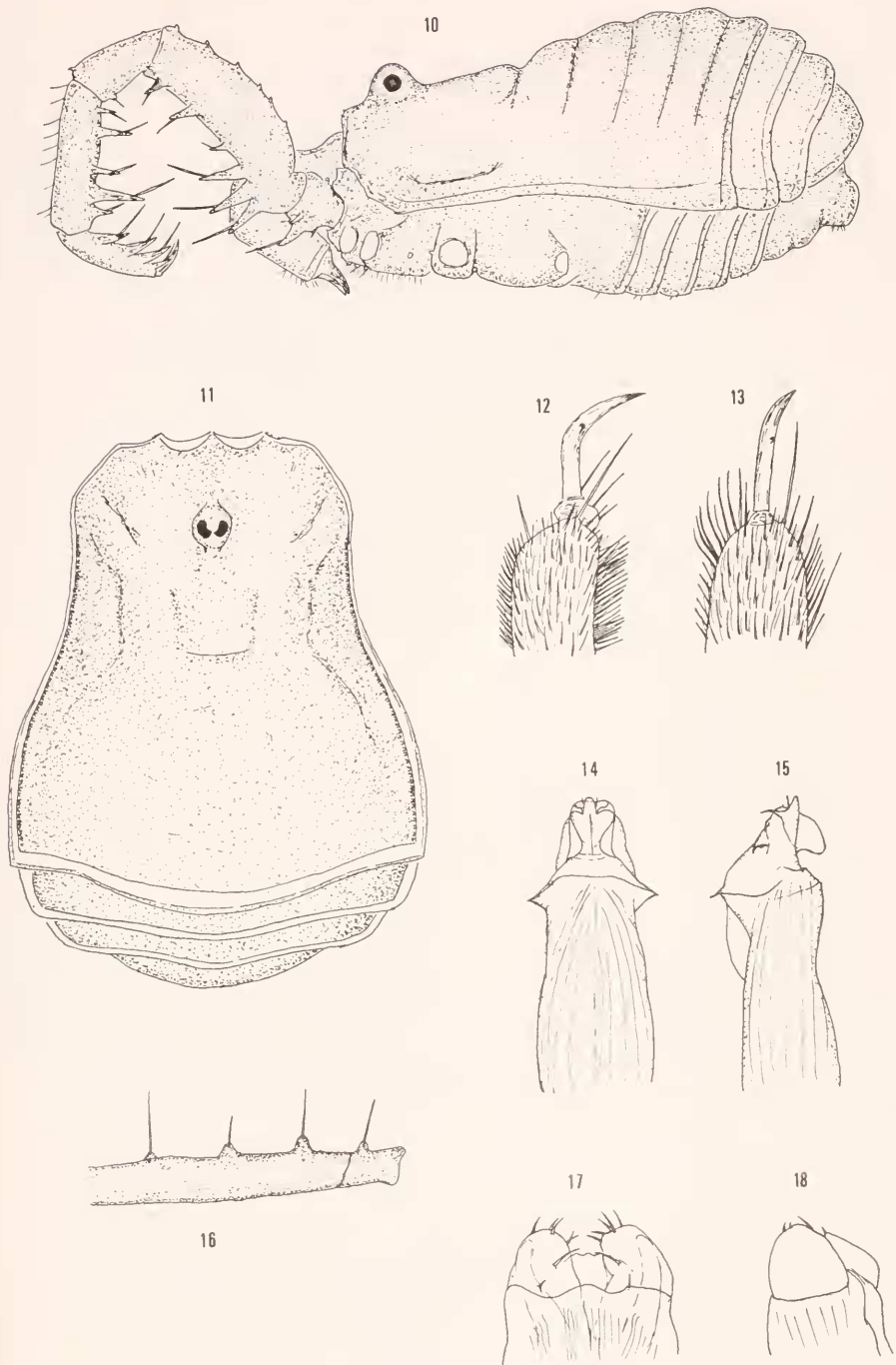
I wish to express my gratitude to Vincent D. Roth and Vincent F. Lee for their help in obtaining references and specimens, and to Dr. Willis J. Gertsh for the loan of material from the American Museum of Natural History. Much of the tedious field work was done by members of the Galileo High School Science Club (San Francisco). Curating was ably done by Kevin Hom and art work performed by Kevin Hom, Jack Tom, and Robert Lem.

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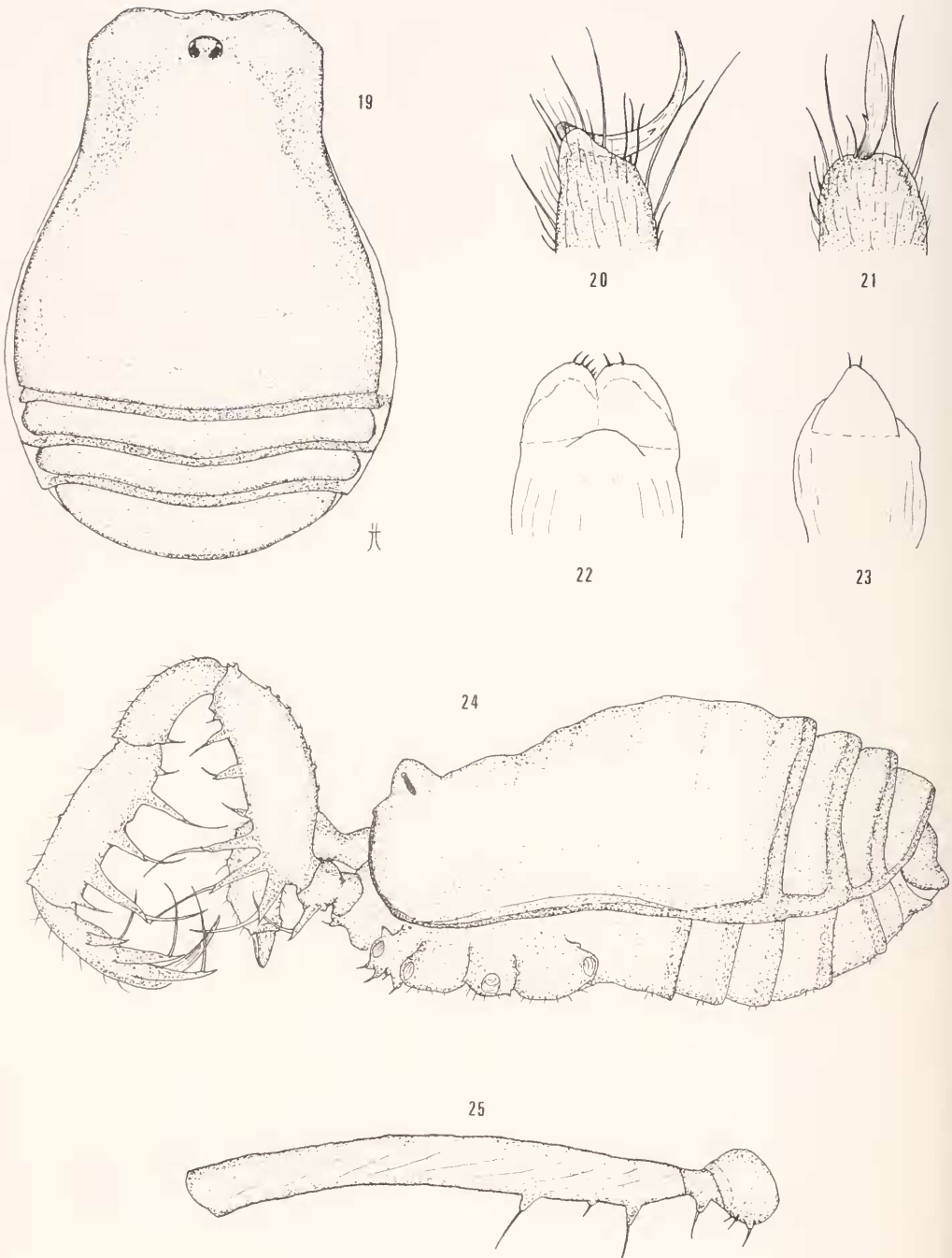
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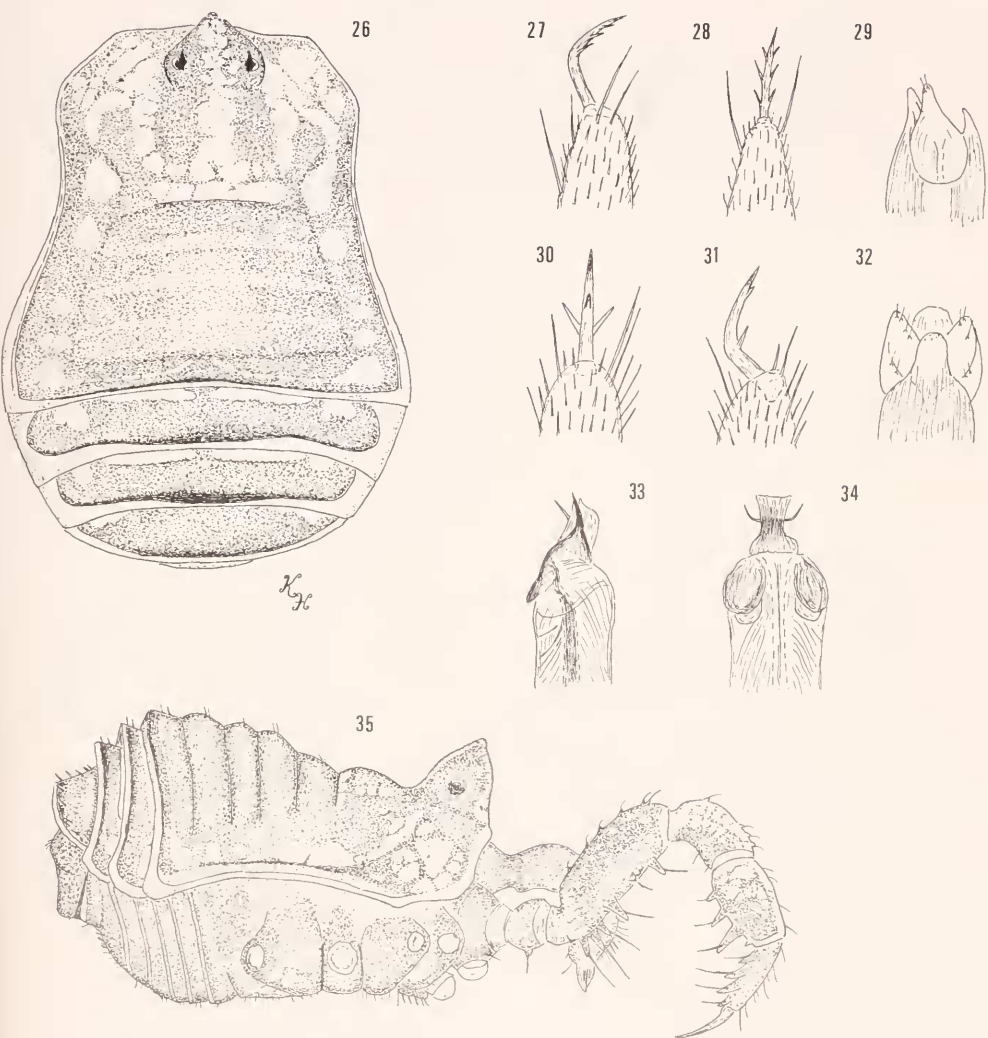
FIGURES 1-9. *Cytobunus cavicolens* Banks. FIGURE 1. Dorsum. FIGURES 2-3. Ventral and lateral views of penis. FIGURE 4. Trochanter to femur of first leg. FIGURE 5. Lateral view. FIGURES 6-7. Lateral and dorsal views of hind claw. FIGURES 8-9. Ventral and lateral views of ovipositor.



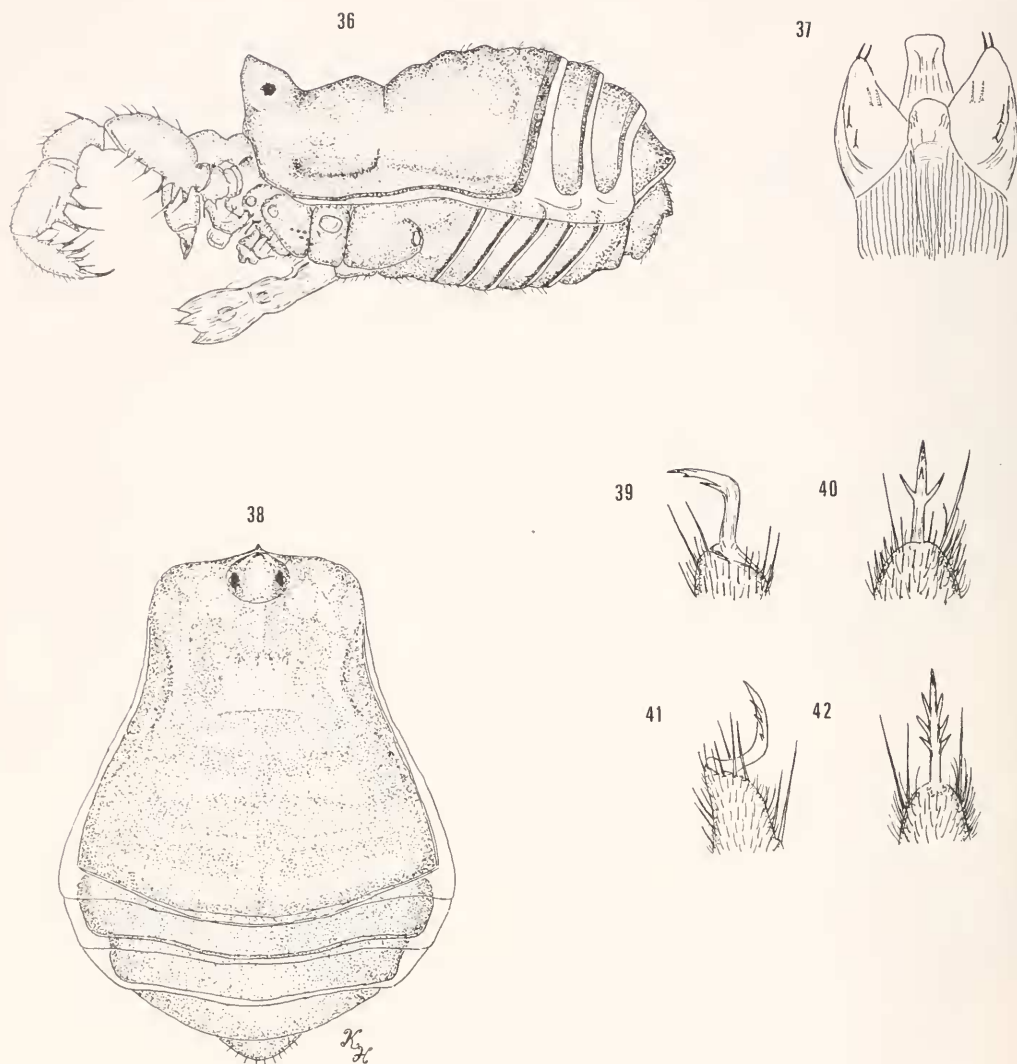
FIGURES 10-18. *Cytobunus unguulatus unguulatus* Briggs, new species. FIGURE 10. Dorsum. FIGURE 11. Lateral view. FIGURES 12-13. Lateral and dorsal views of hind claw. FIGURES 14-15. Ventral and lateral views of penis. FIGURE 16. Femur and second trochanter of first leg. FIGURES 17-18. Ventral and lateral views of ovipositor.



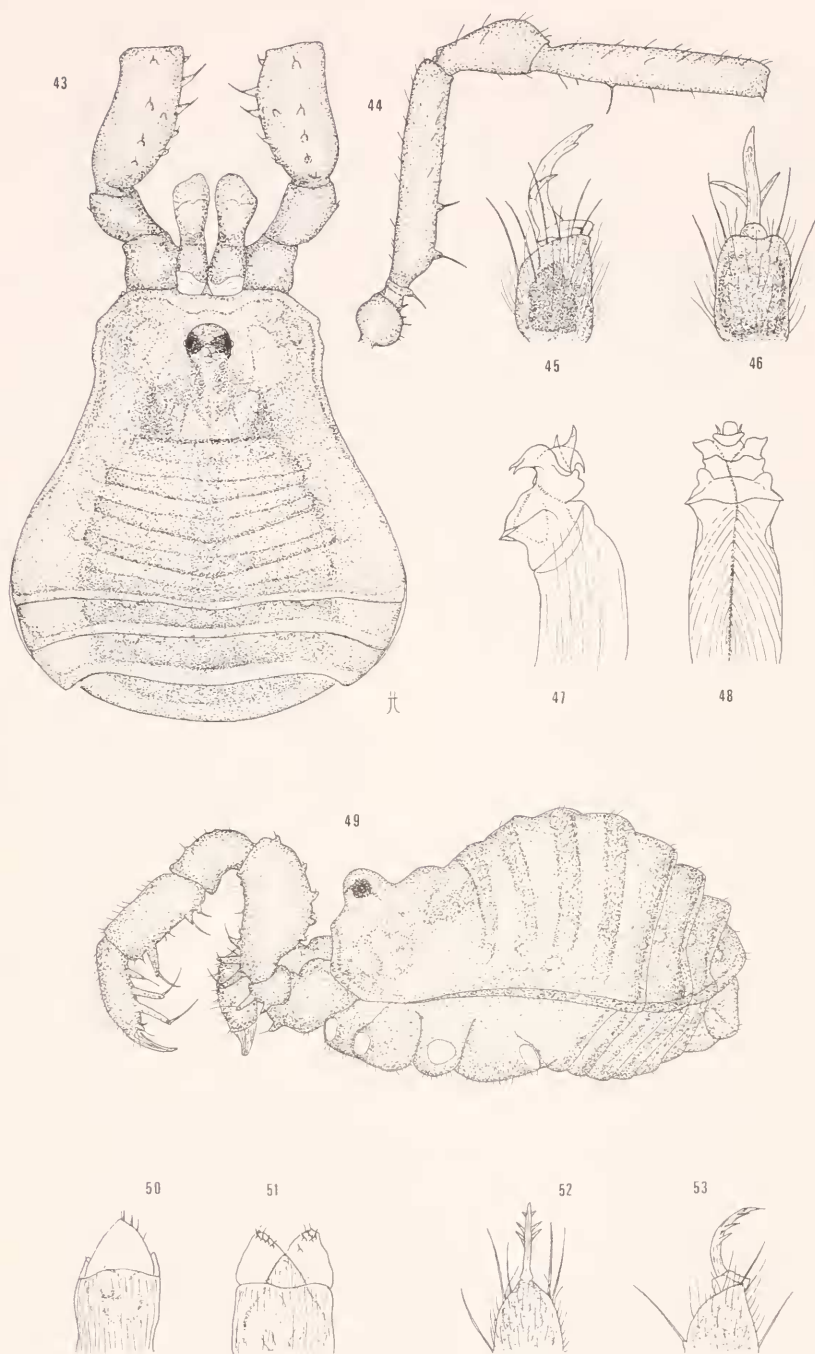
FIGURES 19-25. *Cytobunus ungulatus madhousensis* Briggs, new subspecies. FIGURE 19. Dorsum. FIGURES 20-21. Lateral and dorsal views of hind claw. FIGURES 22-23. Ventral and lateral view of ovipositor. FIGURE 24. Lateral view. FIGURE 25. Femur to trochanter of first leg.



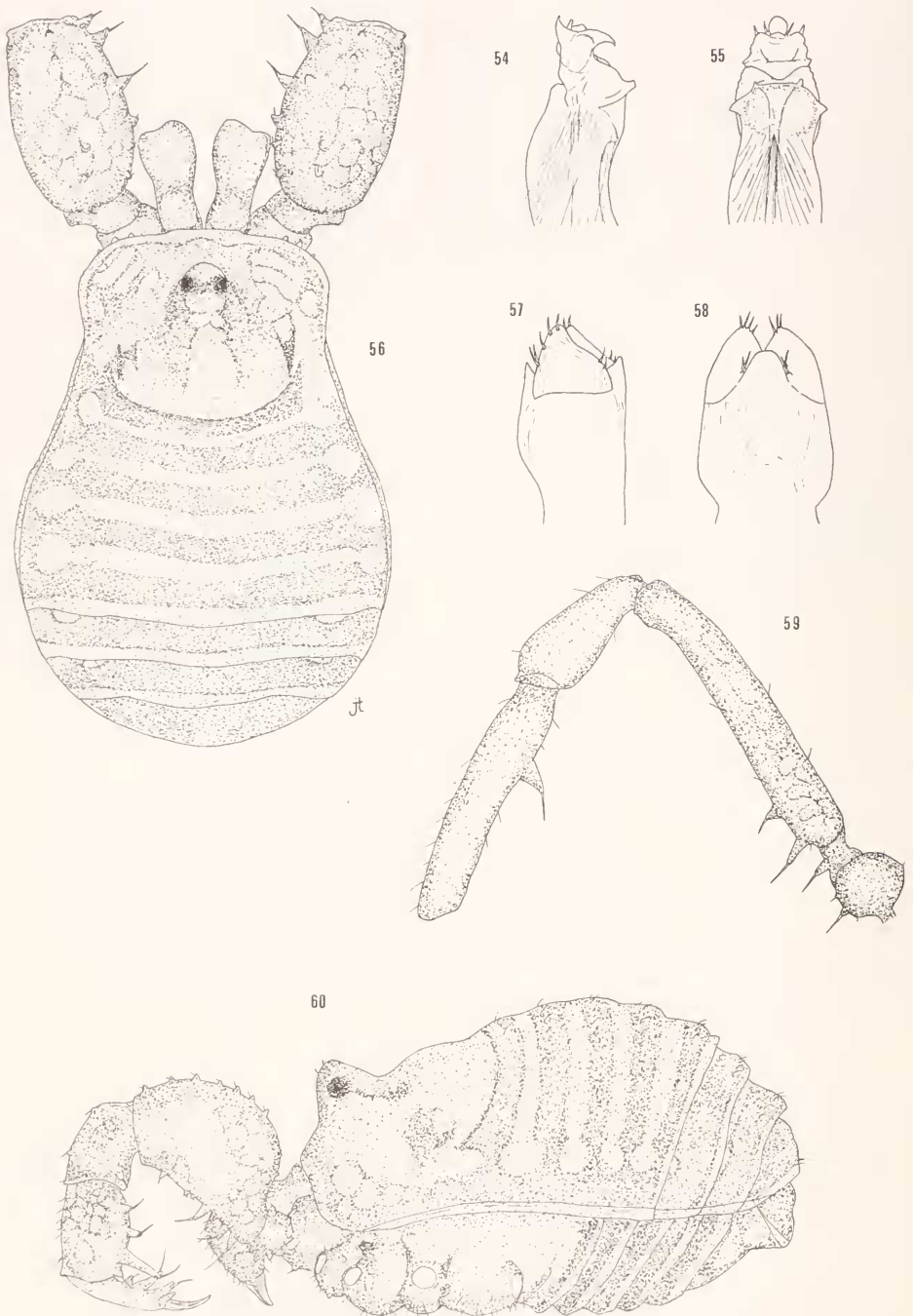
FIGURES 26-35. *Zuma acuta* Goodnight and Goodnight.
FIGURE 26. Dorsum. FIGURES 27-28. Lateral and dorsal views
of juvenile hind claw. FIGURE 29. Lateral view of ovi-
positor. FIGURES 30-31. Ventral and lateral views of adult
hind claw. FIGURE 32. Venter of ovipositor. FIGURES 33-34.
Lateral and ventral views of penis. FIGURE 35. Lateral view.



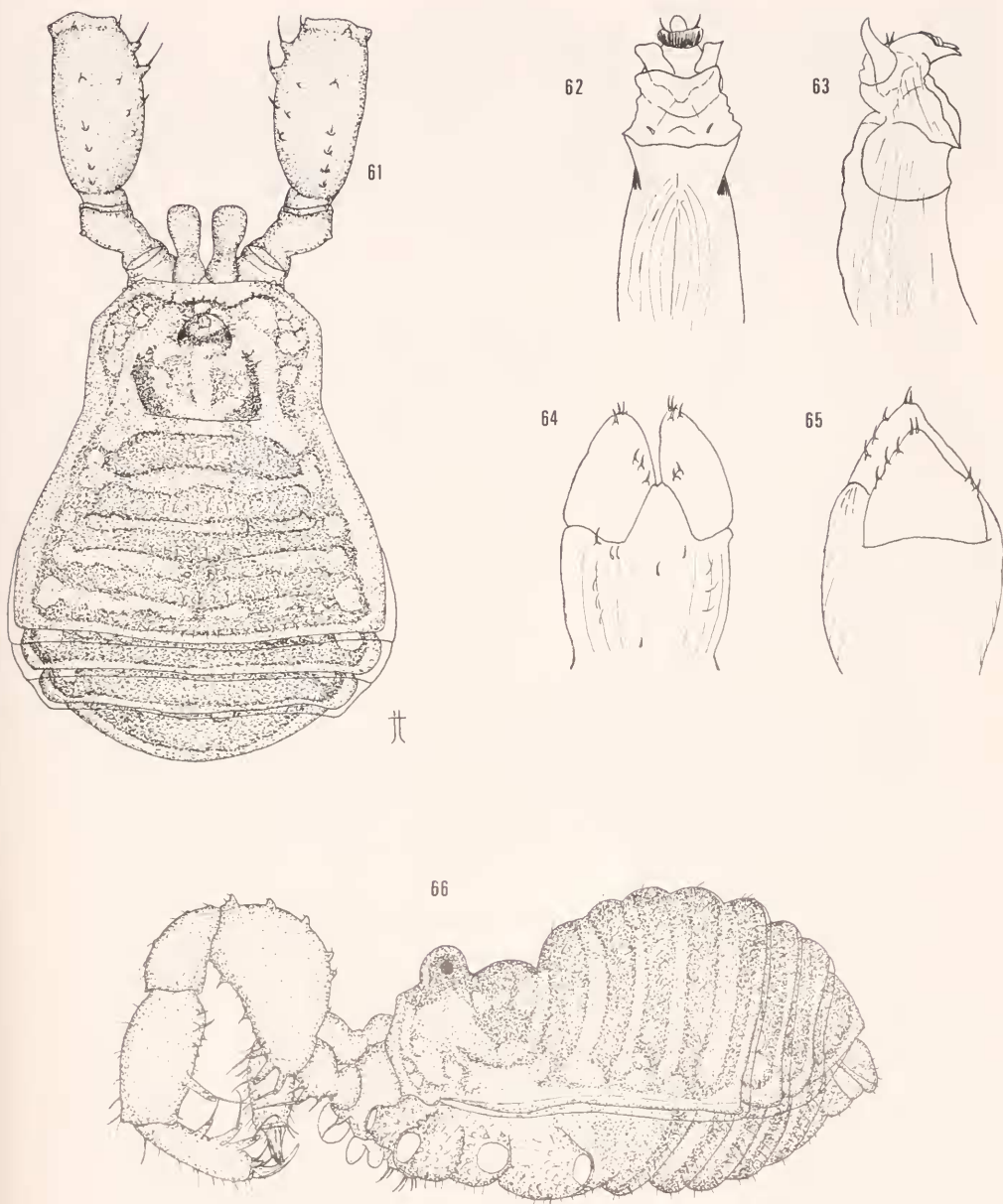
FIGURES 36-42. *Zuma tioga* Briggs, new species.
FIGURE 36. Lateral view. FIGURE 37. Venter of ovipositor.
FIGURE 38. Dorsum. FIGURES 39-40. Lateral and ventral
views of adult hind claw. FIGURES 41-42. Lateral and
dorsal views of juvenile hind claw.



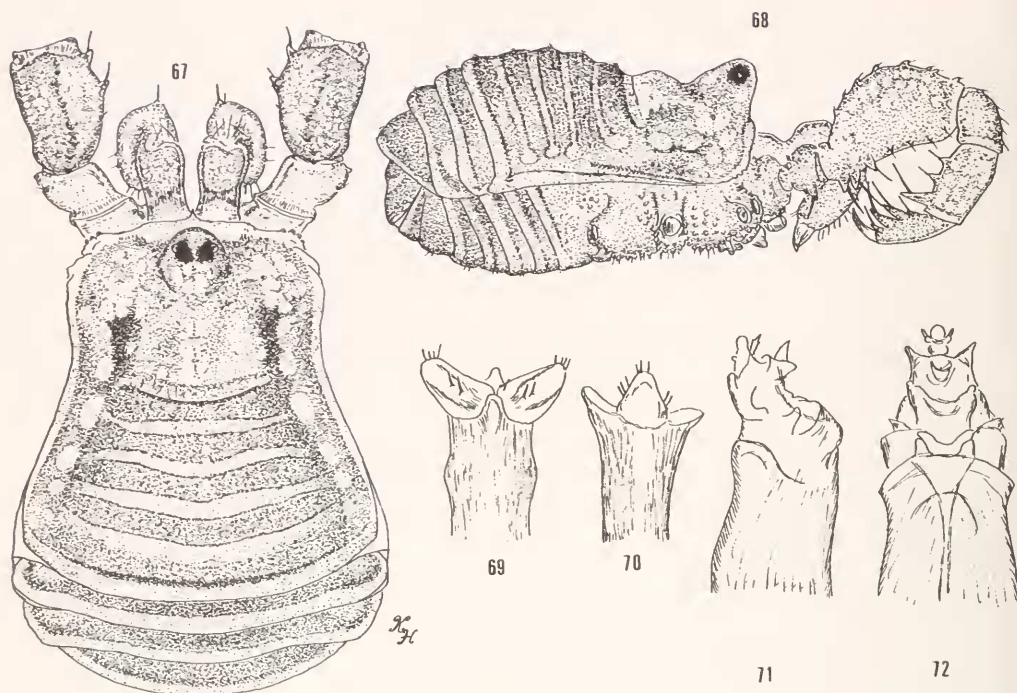
FIGURES 43-53. *Sclerobunus nondimorphicus* Briggs, new species. FIGURE 43. Male dorsum. FIGURE 44. Trochanter to tibia of first leg. FIGURES 45-46. Lateral and ventral views of adult hind claw. FIGURES 47-48. Lateral and ventral views of penis. FIGURE 49. Lateral view of male. FIGURES 50-51. Lateral and ventral views of ovipositor. FIGURES 52-53. Dorsal and lateral views of juvenile hind claw.



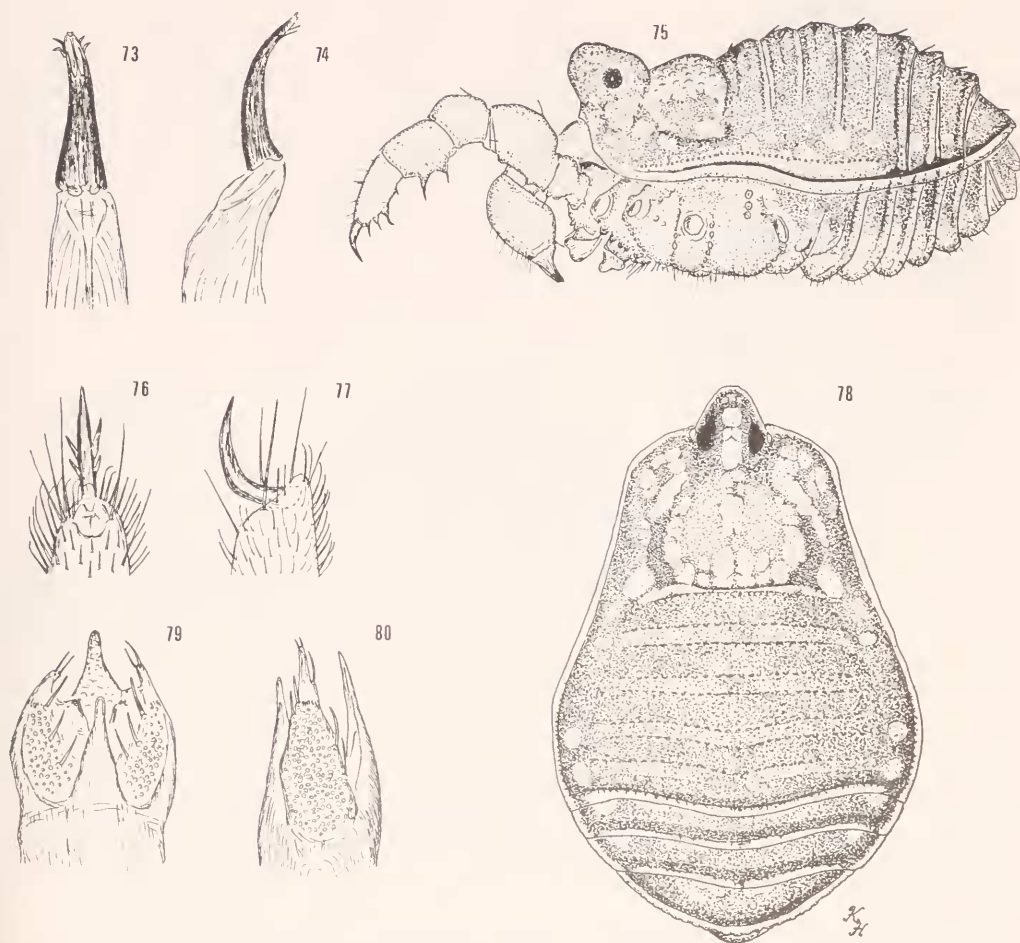
FIGURES 54-60. *Sclerobunus robustus robustus* (Packard).
 FIGURES 54-55. Lateral and ventral views of penis. FIGURE
 56. Male dorsum. FIGURES 57-58. Lateral and ventral views
 of ovipositor. FIGURE 59. Tibia to trochanter of first leg.
 FIGURE 60. Lateral view of male.



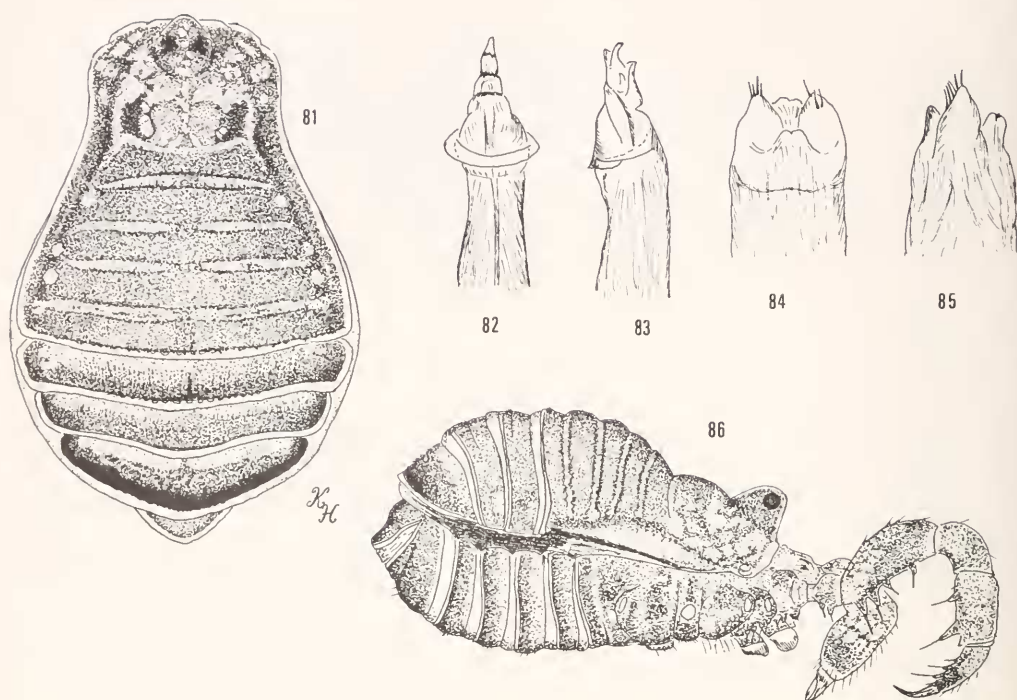
FIGURES 61-66. Sclerobunus robustus idahoensis Briggs, new subspecies. FIGURE 61. Male dorsum. FIGURES 62-63. Ventral and lateral views of penis. FIGURES 64-65. Ventral and lateral views of ovipositor. FIGURE 66. Lateral view of male.



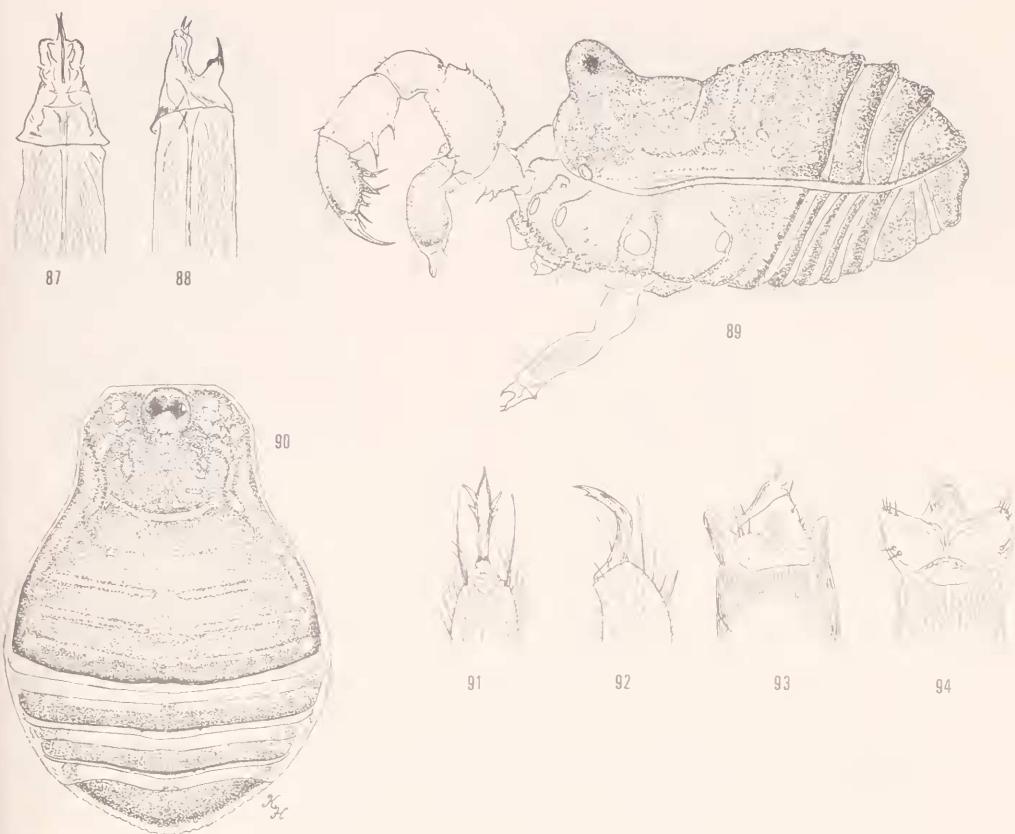
FIGURES 67-72. Sclerobunus robustus glorietus Briggs, new subspecies. FIGURE 67. Male dorsum. FIGURE 68. Lateral view of male. FIGURES 69-70. Ventral and lateral views of ovipositor. FIGURES 71-72. Lateral and ventral views of penis.



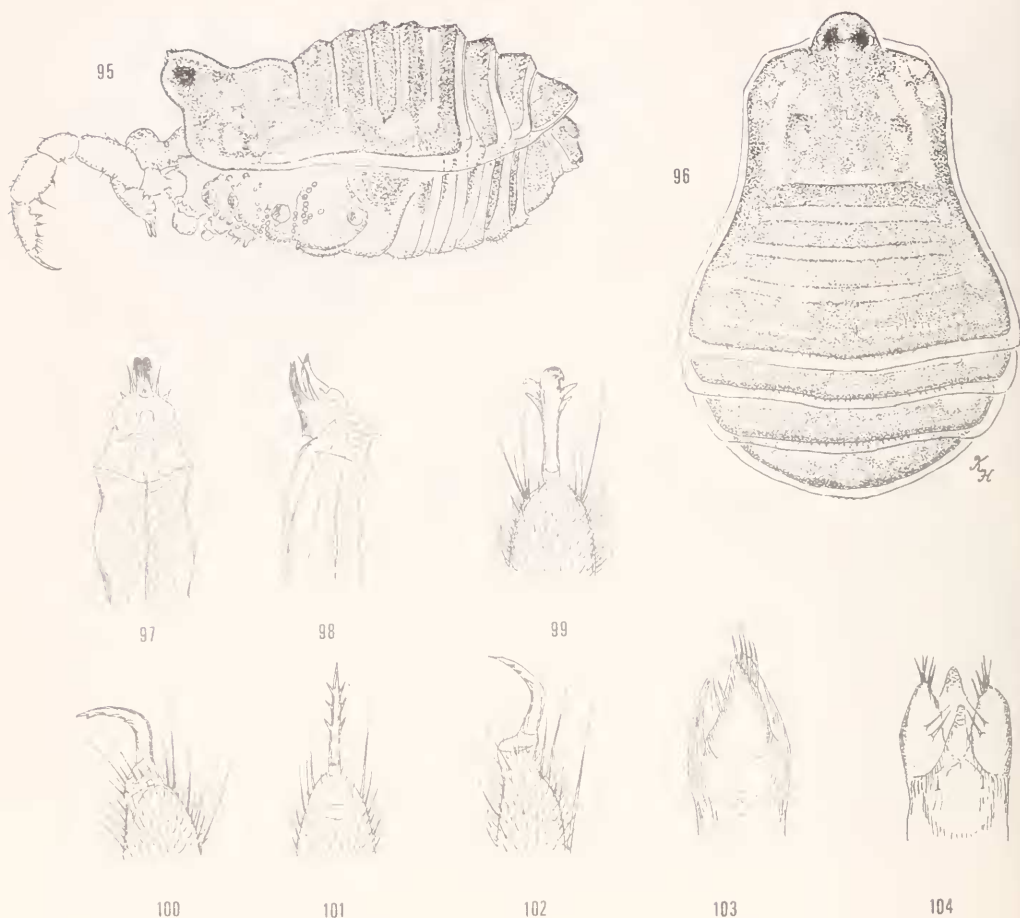
FIGURES 73-80. *Paranonychus brunneus* (Banks). FIGURES 73-74. Ventral and lateral views of penis. FIGURE 75. Lateral view. FIGURES 76-77. Dorsal and lateral views of hind claw. FIGURE 78. Dorsum. FIGURES 79-80. Ventral and lateral views of ovipositor.



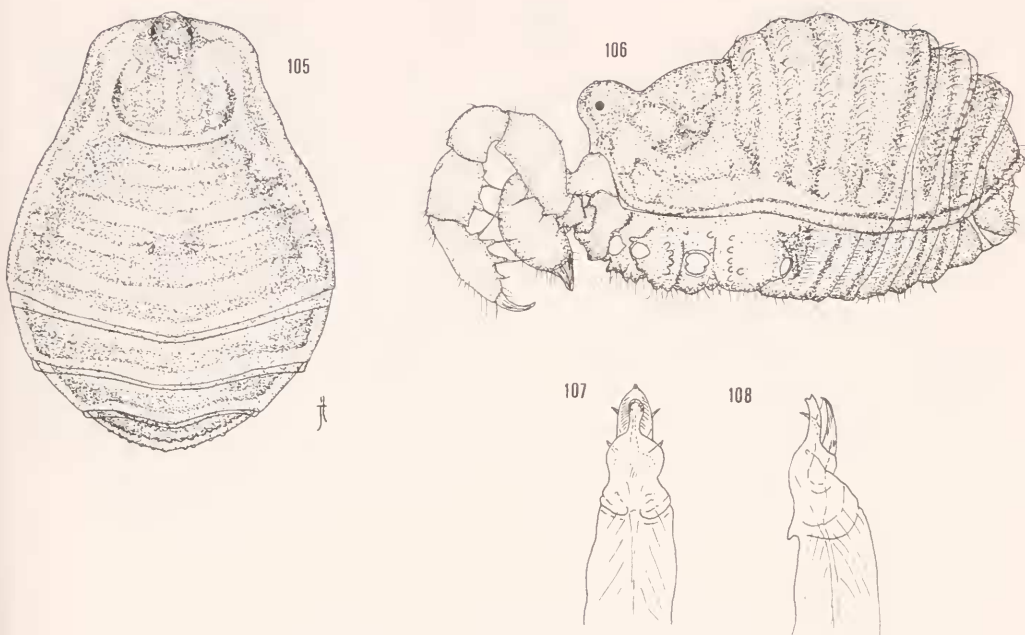
FIGURES 81-86. Metanonychus nigricans nigricans Briggs, new species. FIGURE 81. Dorsum. FIGURES 82-83. Ventral and lateral views of penis. FIGURES 84-85. Ventral and lateral views of ovipositor. FIGURE 86. Lateral view.



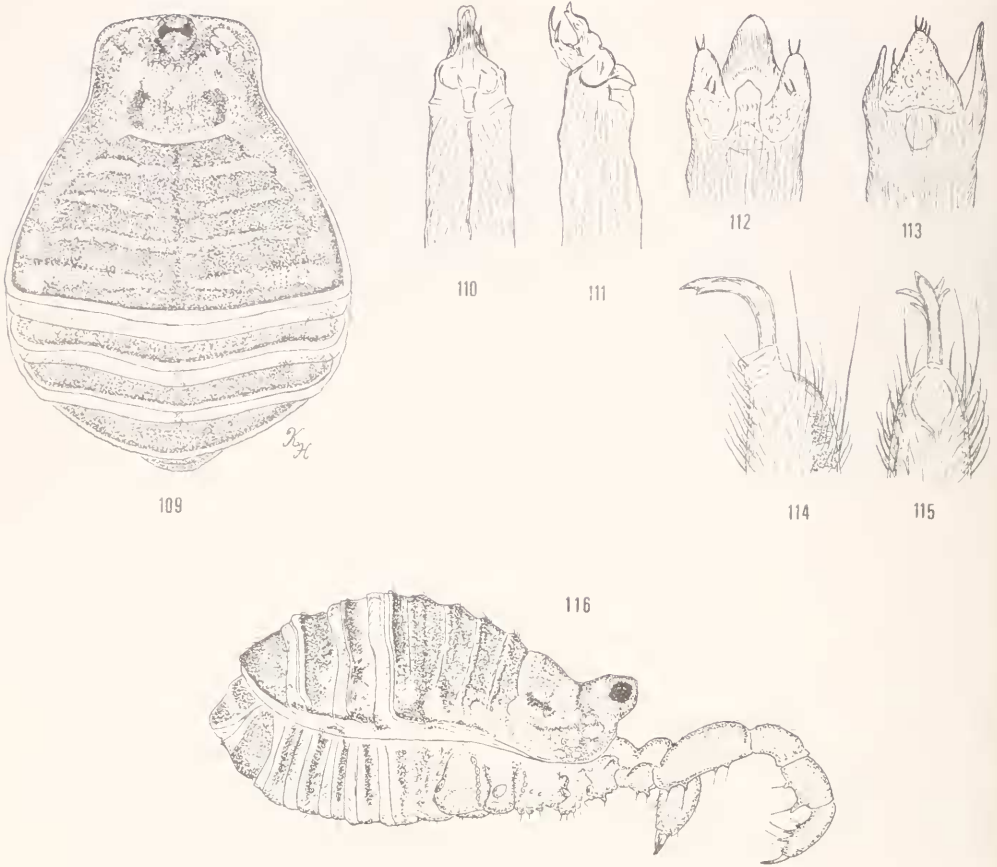
FIGURES 87-94. *Metanonychus nigricans oregonus* Briggs, new species. FIGURES 87-88. Ventral and lateral views of penis. FIGURE 89. Lateral view of male. FIGURE 90. Dorsum. FIGURES 91-92. Dorsal and lateral views of hind claw. FIGURES 93-94. Lateral and ventral views of ovipositor.



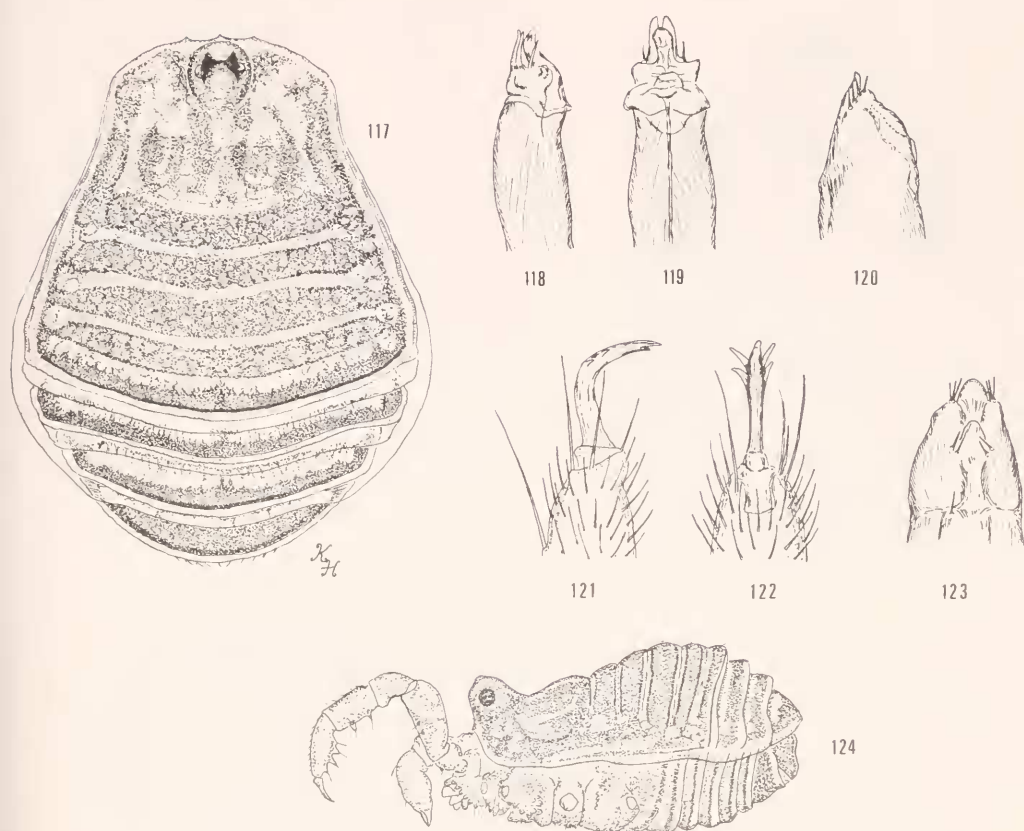
FIGURES 95-104. *Metanonychus idahoensis* Briggs, new species. FIGURE 95. Lateral view of male. FIGURE 96. Dorsum. FIGURES 97-98. Ventral and lateral views of adult claw. FIGURES 101-102. Dorsal and lateral views of juvenile claw. FIGURES 103-104. Lateral and ventral views of ovipositor.



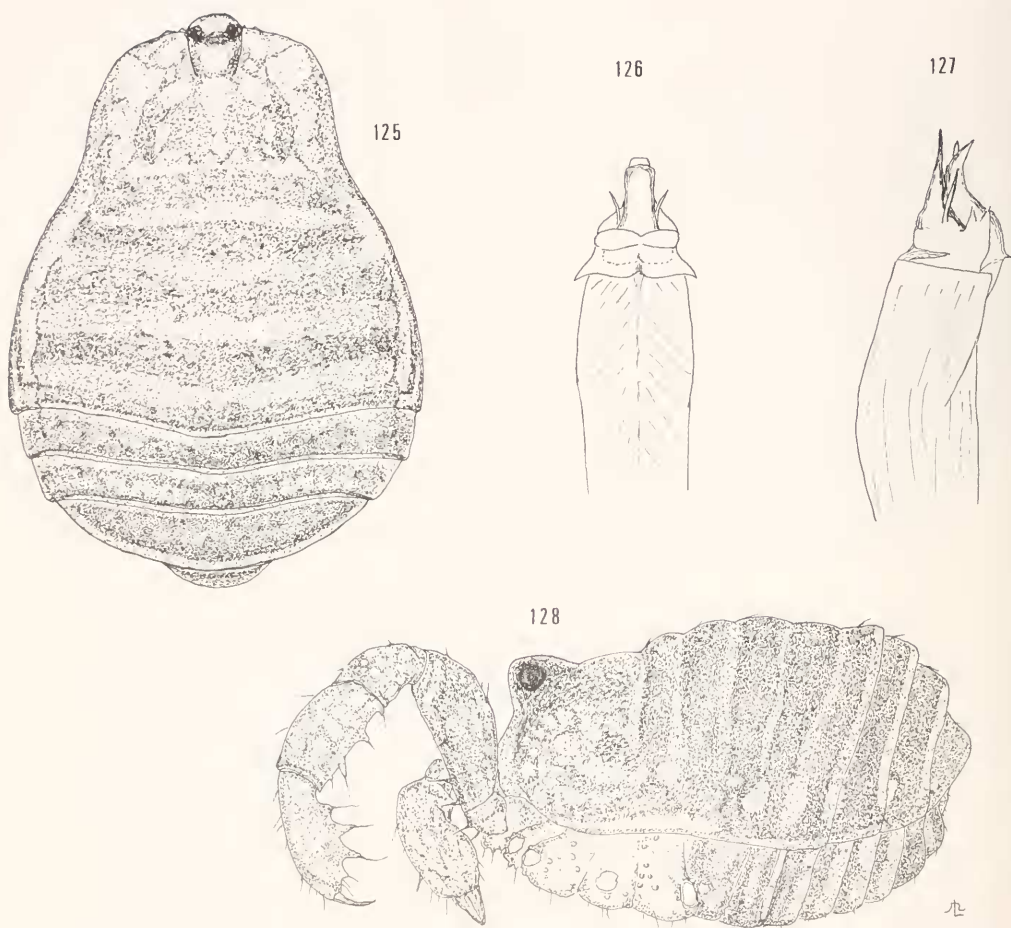
FIGURES 105-108. Metanonychus setulus setulus Briggs, new species. FIGURE 105. Dorsum. FIGURE 106. Lateral view. FIGURES 107-108. Ventral and lateral views of penis.



FIGURES 109-116. *Metanonychus setulus mazamus* Briggs, new subspecies. FIGURE 109. Dorsum. FIGURES 110-111. Ventral and lateral views of penis. FIGURES 112-113. Ventral and lateral views of ovipositor. FIGURES 114-115. Lateral and dorsal views of claw. FIGURE 116. Lateral view.



FIGURES 117-124. *Metanonychus setulus navarrus* Briggs, new subspecies. FIGURE 117. Dorsum. FIGURES 118-119. Lateral and ventral views of penis. FIGURE 120. Lateral view of ovipositor. FIGURES 121-122. Lateral and dorsal views of claw. FIGURE 123. Ventral view of ovipositor. FIGURE 124. Lateral view.



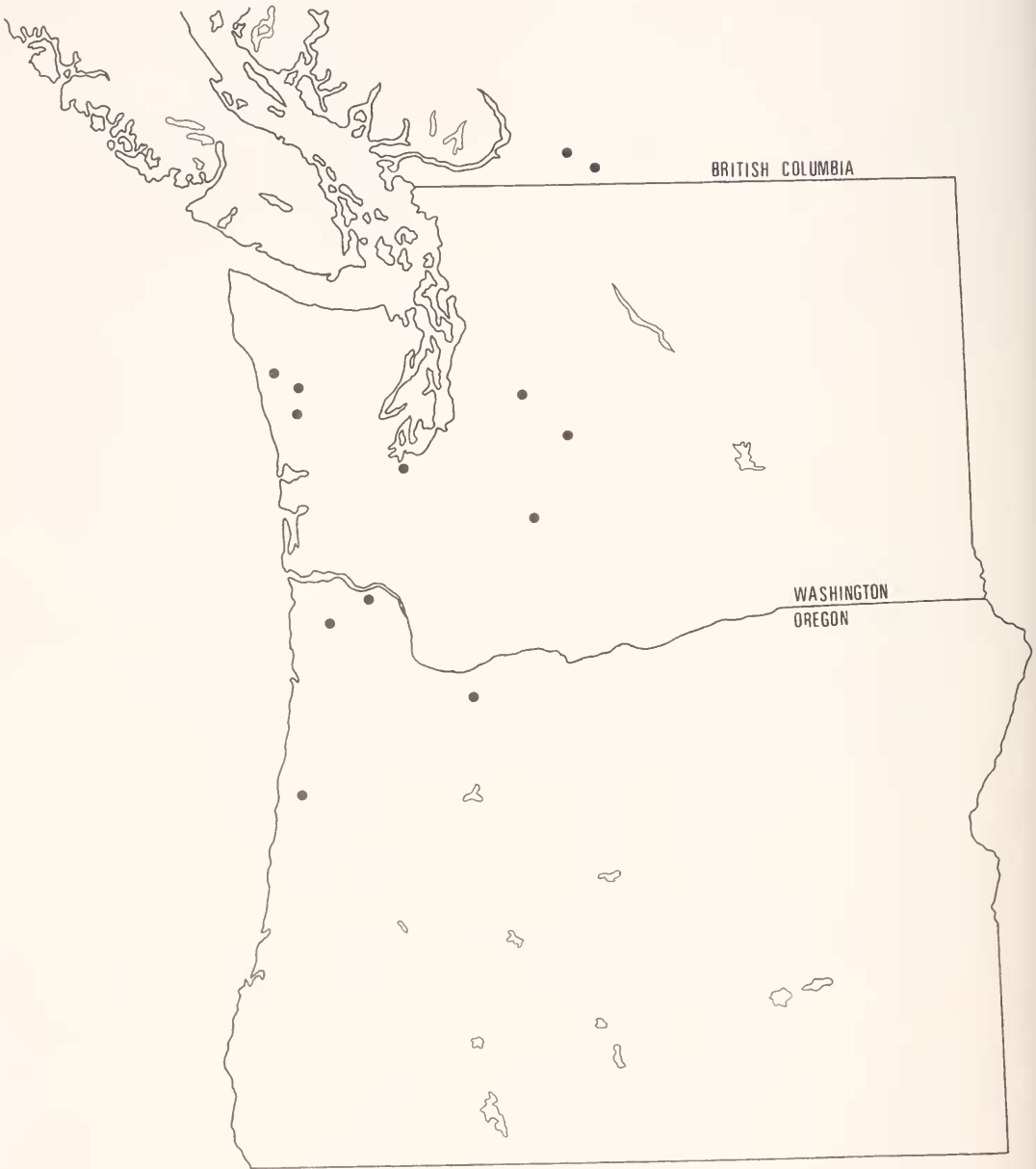
FIGURES 125-128. Metanonychus setulus obrieni Briggs, new subspecies. FIGURE 125. Dorsum. FIGURES 126-127. Ventral and lateral views of penis. FIGURE 128. Lateral view.

LEGEND

- *S. r. robustus*
- *S. r. idahoensis*
- *S. r. glorietus*
- △ *C. v. unguatus*
- ▲ *C. v. madhousensis*
- *C. cavicolens*



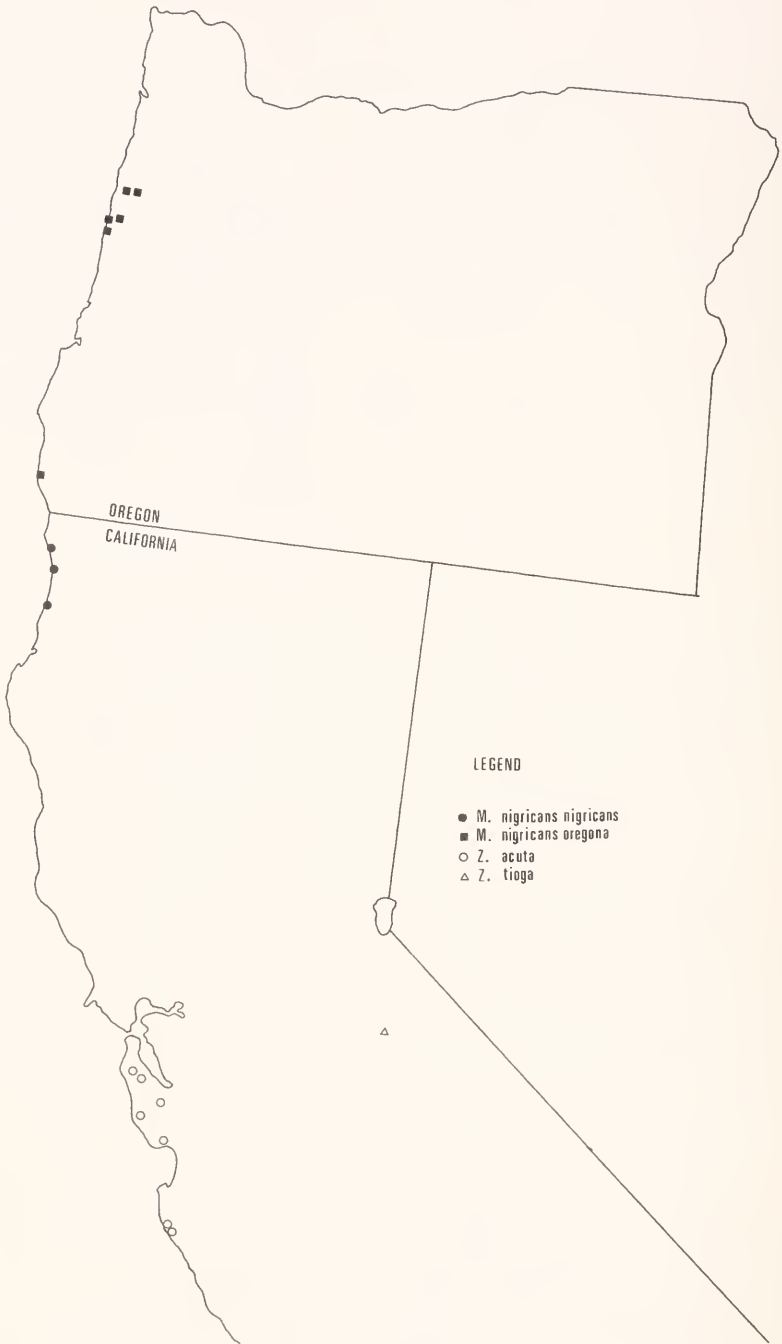
MAP 1. Distributions of Sclerobunus robustus and Cytobunus.



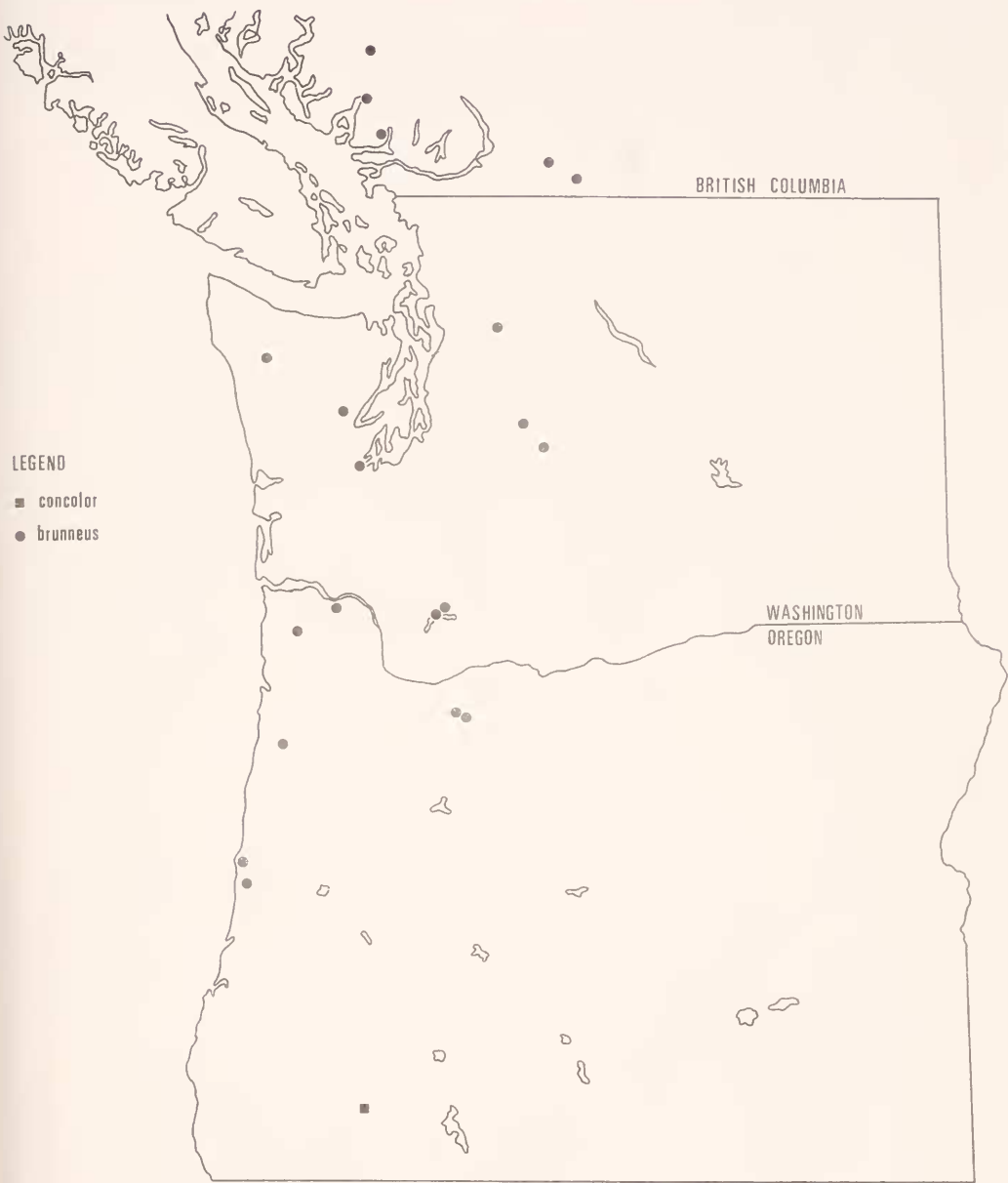
MAP 2. Distribution of Sclerobunus nondimorphicus.



MAP 3. Distributions of Metanonychus idahoensis and M. setulus.



MAP 4. Distributions of Metanonychus and Zuma.



MAP 5. Distributions of Paranonychus concolor and P. brunneus.